Technical Report

Merrimack River Watershed Wetland Restoration Strategy

Prepared for **NH Department of Environmental Services**
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An Overview of Wetland Restoration

1.1 Introduction

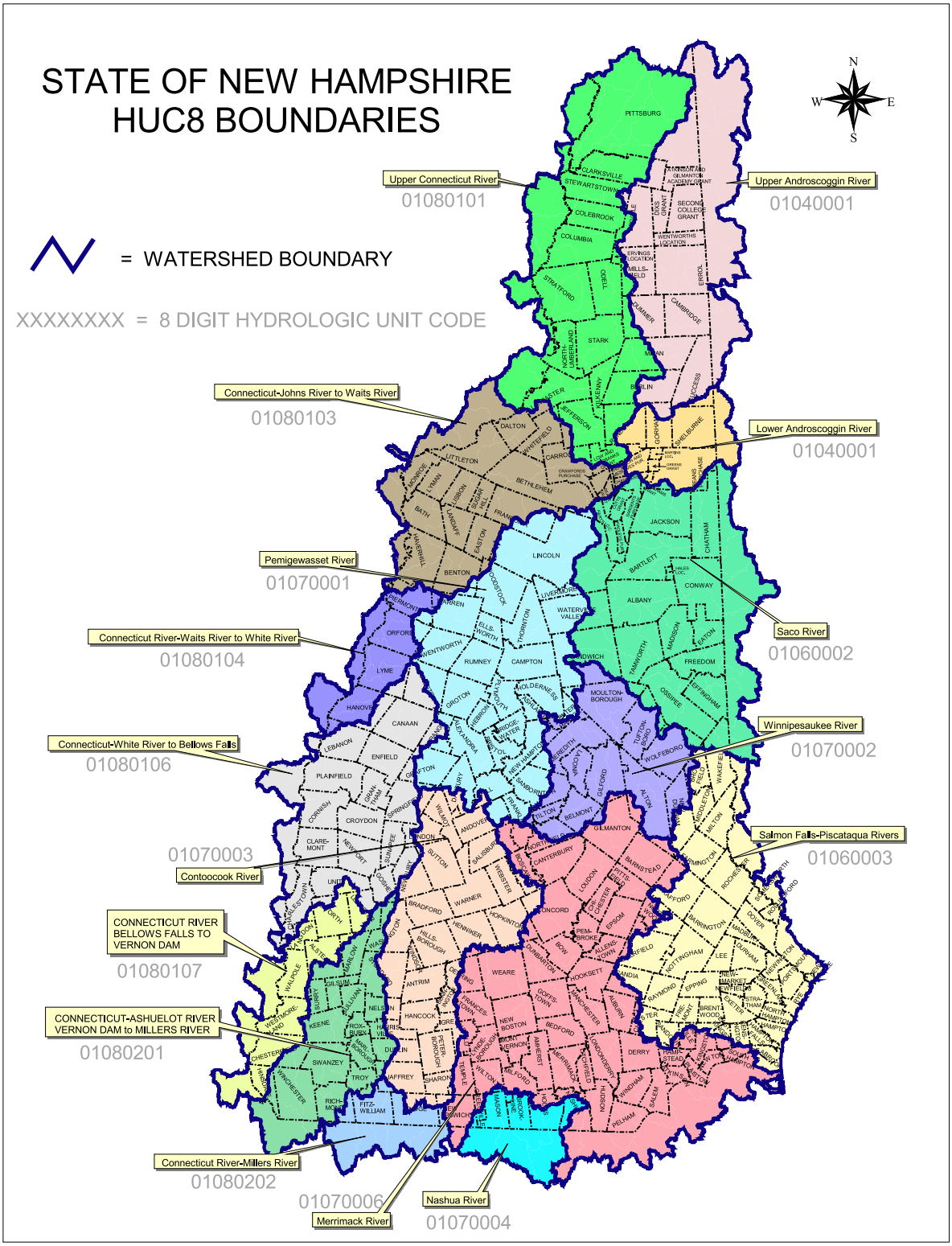
Wetlands are widely known to be critical to protect water quality, to provide wildlife habitat, to mitigate floods, and to provide many other important natural functions. Although New Hampshire has been relatively successful in protecting wetland resources, many have been degraded by past and current land uses and more are impacted each year as the state grows. Restoration of these degraded areas holds great potential to help improve New Hampshire's water quality, wildlife habitat and general quality of life.

1.1.1 The ARM Fund

The recent development of the "Aquatic Resource Mitigation Fund" (ARM Fund) has provided a promising new source of grant money to help with wetland restoration efforts. These funds are available to New Hampshire cities and towns to implement programs to restore, protect or create aquatic habitats. The fund accepts payments ("in-lieu fees") made by applicants for state wetland dredge and fill permits under RSA 482-A, who pay into the fund to help offset ("mitigate") the impacts of their proposed projects. These funds are then pooled on a watershed basis and managed by the NH Department of Environmental Services (NHDES) and a Site Selection Committee made up of watershed stakeholders. The intent of the fund is to provide grants to environmental and community organizations to conduct worthwhile projects that will yield environmental benefits in the watershed.[1]

Figure 1-1 shows a map of the sixteen "HUC-8" watersheds in NH. The ARM Fund comprises 16 accounts which correspond to each one of the watersheds; the law requires that in-lieu fee payments made by a project within a particular watershed be

[1] **Appendix A** contains the portion of RSA 482-A which references the establishment of the ARM Fund, as well as the Memorandum of Understanding between the NHDES and the US Army Corps of Engineers that allows use of "in-lieu fee" payments to be used for wetland mitigation.



Vanasse Hangen Brustlin, Inc.

Source: NH Department of Environmental Services

Figure 1-1

HUC-8 Watersheds

Merrimack River Watershed
Wetland Restoration Strategy

spent within that same watershed [RSA 482-A:31,III(c)]. The Merrimack River Watershed contains the largest amount of funds collected to date (more than $650,000 through the end of January 2009), and it is also the first watershed for which ARM funds are available.[2]

1.1.2 Development of a Wetland Restoration Assessment Model (WRAM)

Conservation organizations have developed a tremendous amount of information on ecologically important areas in New Hampshire over the years - with a focus on preservation. Additionally, excellent progress has been made in NH's coastal region on restoring salt marsh habitat. But relatively little is known about potential wetland restoration sites in the Merrimack River Watershed and other watersheds in the state. To address the need, The NHDES, working with its partners at the NH Fish and Game Department, the US Environmental Protection Agency and other state and federal partners, have commissioned this study of the Merrimack River Watershed.

A thorough and systematic study of wetland restoration opportunities in the basin will help to promote environmental restoration and assist in the decision making process for public and private expenditures. A clear, science-based understanding of these wetlands will help focus energy on the approach for restoration efforts and will ensure that funds are used efficiently. The resulting information can be used by concerned citizens and community organizations to identify promising wetland restoration projects and to generate interest in planning and conducting projects.

Because of the large scale of this watershed (1,672 square miles), the development and application of an automated geospatial model to identify and prioritize potential wetland restoration sites was determined necessary. The overall goal of the project was to build a Geographic Information System (GIS) model of the Merrimack River watershed and to utilize the model to identify wetlands that may be impacted by past land uses and to understand which of those wetlands may benefit the most from restoration. The project aims to develop a model that is specific enough to provide reliable results in the Merrimack River Watershed, but general enough so that it can be applied to other watersheds in New Hampshire in the future. This model will be called the Wetland Restoration Assessment Model (WRAM), and its development and function is explained in detail in Chapter 2.

The overall goal of the project is to build a Geographic Information System (GIS) model of the Merrimack River watershed and to apply the model to identify wetlands that may be impacted by past land uses and to understand which of those wetlands may benefit the most from restoration.

The purpose of this report is to explain the GIS model and the results of this study, and it is hoped that the results will be helpful to those who want to help protect and restore wetlands. It is very important to understand that, due to the limitations of GIS, *the model cannot identify or assess <u>all</u> potential restoration opportunities*. While the results suggest that there are numerous opportunities throughout the watershed, and

[2] Funds for seven other watersheds will become available later in 2009, 2010 and into 2011; no ARM Fund payments have yet been made for the remaining eight watersheds.

that the model does a good job of identifying those opportunities, it is also clear that local Conservation Commissions and other local and regional organizations may know of other viable wetland restoration sites that are not included in this study. The exclusion of these sites should not be taken as evidence that such a site would not qualify for an ARM grant or other funding sources.

1.2 Methods of Wetland Restoration

Before reviewing the GIS model and its results, it may be useful to discuss the various ways that a wetland can be degraded and the ways to remedy that impairment. This section therefore focuses on the common types of impacts to the freshwater wetlands in the watershed, and briefly summarizes some of the techniques that can be used to restore wetlands.

1.2.1 Wetland Fill Removal

Over the years, wetland areas were filled to accommodate development or in an effort to improve the land for residential, commercial or farming uses. This constitutes a common mode of wetland loss. Filled wetlands are nearly always destroyed and lose all wetland functions and values. However, removal of the fill - in cases where it would not impact a roadway, building or other structure - can be effective in restoring the area to a functional wetland. In some cases, the wetland can be expanded by extending the excavation into upland areas, a strategy that is often called "wetland creation" or "wetland construction."

Wetland restoration is the process of using ecological principles and experience to return a degraded wetland system to a more ecologically functional state. The goal of this process is to emulate the structure, function, diversity, and dynamics of the original wetland.

The creation of new wetlands and the restoration of filled wetlands are similar in many ways. The primary difference is that wetland creation projects begin with naturally occurring upland landforms whereas restoration of filled wetlands begin with filled landforms.[3] Both involve a sequence of similar planning and implementation, including shaping the landscape with heavy equipment, then establishing the right soil conditions and a wetland plant community from scratch on the graded substrate.

Implementation of a wetland restoration project begins by establishing project limits in the field and putting erosion and sediment control structures in place. Fill is removed to the level of the original wetland, or upland soils are excavated to desired elevations using heavy equipment. Graded surfaces are often left rough rather than graded smooth to simulate naturally occurring micro-topography (e.g. "pit and mound" topography characteristic of wetlands).

[3] Generally, it is not beneficial to impact undisturbed uplands to create wetlands. Thus, this wetland creation is most appropriate when limited to upland areas which have been disturbed or degraded.

Wetland restoration projects may utilize native topsoil if it is intact beneath the fill; however, most wetland creations and many restorations require topsoil placement over the graded substrate to provide conditions suitable for plant growth. Wetland topsoil may be salvaged from a permitted wetland fill area, upland topsoil may be salvaged from the upland creation area, or topsoil from an offsite source may be needed. Wetland soils generally have more organic matter than upland topsoil. If topsoil from an upland source is utilized, it is often combined with organic compost to assure it has adequate water holding capacity and nutrients for the wetland plant community. In all cases, the topsoil utilized must be free of seeds, tubers, and root fragments of invasive species.

When selecting planting stock, vegetation must be closely matched to various conditions within the restoration area. Generally, target cover types and the species to be planted are chosen after review of adjacent undisturbed areas (i.e., "reference sites"). However, variation in elevation of a few inches can result in different hydrological regimes suited for different sets of species. The establishment of wetland vegetation may be accomplished in a number of ways. Wetland topsoil with a live seed bank may be salvaged from an associated wetland impact project, as may live plants that would otherwise be destroyed. Wetland seed mixes are available from specialized suppliers, as are live plants. All plants and seeds introduced to the site should be native, non-ornamental varieties, preferably propagated from local genetic stock. Wetland plants and seed mixes should be obtained from a reliable grower and free of invasive species. In areas that are not inundated, a light application of weed-free mulch is useful in the planting design to help keep plants and seeds moist and to help stabilize soils while the vegetation becomes established. Heavy applications of mulch are utilized around plantings of woody species to prevent them from being outcompeted by wetland grasses and forbs until they have grown well above the surrounding plants.

1.2.2 Elimination of Ditching and other Hydrological Modifications

Wetland hydrology - the interaction of surface and ground water with the soil surface - is perhaps the defining characteristic of a wetland, and is the primary determinant of its ecological features including the composition of its dominant vegetation and faunal community, its biogeochemical dynamics, and its water quality. The natural hydrology of a wetland can be affected by excavation of drainage ditches, installation of field tile in agricultural fields, as well as construction of dikes or dams. This is a pervasive form of wetland impact throughout the watershed, and is one that is fairly easy to diagnose and remedy.

Ditching was common practice throughout the state to drain wetlands for agriculture and for other purposes. When viewing aerial photographs, ditches typically appear as a grid pattern, although some ditch systems may more closely resemble natural channel patterns. In some cases, these ditches are, in fact, dredged stream channels – lowering the bed of the stream has the effect of lowering the groundwater table in the vicinity of the impacted stream.

Although not as apparent, subsurface drains were installed in many wet areas to improve the area for farming. "Drain tile" or "field tile" as it is often called, is usually made of clay or perforated plastic and buried at a depth of two to six feet. While surface water can be drained by open ditches, tile drainage was used extensively to lower subsurface water, and is still a common practice in some areas of the country. In a tile drainage system, a network of below-ground pipes allows subsurface water to move out from between soil particles and into the tile line. Water flowing through tile lines is carried to surface water discharge points -- lakes, streams, and rivers -- located at a lower elevation than the source. Water enters the tile line either via the gaps between tile sections, in the case of older tile designs, or through small perforations in modern plastic tile.

Ecologically, these drainage systems, while sometimes necessary to allow agricultural production, have obvious adverse effects on wetlands. By lowering the water table, the wetland is often effectively destroyed, while in other cases it decreases the diversity and productivity of the wetland. Invasive species often become dominant in drained wetlands. In bypassing the natural flow of water from the surface to the water table, drainage systems often prevent groundwater recharge and the natural filtration of water provided by soils and wetlands. Drainage systems can impact surface waters by directly discharging water laden with fertilizers, eroded soil, agrochemicals, and other types of runoff.

Wetland systems can also be affected by diking or damming. Although this mode of impact was considered in this study, it was ultimately decided that impounded sites would not be prioritized over other forms of impairment. Note that the objective of the damming often was to improve habitat or manage for a specific set of species (e.g., ducks and other waterfowl). While management sometimes involves an ecological tradeoff and can have adverse ecological effects on non-target species, it was determined that there is an abundance of good restoration sites without including these impounded sites.

Remediation of hydrological modifications can be relatively easy and inexpensive and is a very effective restoration technique.

The simplest restoration, a **tile break**, involves removing a section of underground agricultural tile that is draining a wetland. Generally, a contractor with a backhoe is used to remove or crush a 25 to 50 ft section of tile downstream of the wetland. The downstream end or outlet pipe can be plugged with concrete or clean clay fill, and the trench is filled. It is also possible to manage tile drains by connecting their outlet to a "riser" at the downstream (outlet) end of the tile line. The riser effectively raises the outlet elevation and will establish the controlling elevation in the entire upstream system. Water will fill the drain tile until it reaches the outlet of this riser. This can work well if adaptive management is desired (the height of the riser can be modified to manage water levels in the system) or where the location of the drain tiles is unknown. It can also be used to maintain downstream drainage if needed.

For excavated ditches, a **ditch plug** consisting of an earthen wall can effectively eliminate the influence of the ditch by establishing a new controlling elevation along

the ditch or at its outlet. In practice, several ditch plugs may be necessary in a ditch system to be effective. This type of restoration uses equipment to fill a portion of a drainage ditch to natural ground level. Again, a riser or culvert may be used to let water flow through an outlet pipe once it reaches a certain level. A small dike or berm may also be used, which will impound the water that will begin to collect once the draining has been eliminated. A dike prevents the drainage of water downstream and requires a spill way or other water-control structure to regulate the water level and prevent the dike from being washed away during periods of heavy runoff.

1.2.3 Invasive Species Control

Over the last few decades, several invasive species have come to inhabit New Hampshire wetlands, and their presence in a wetland is usually indicative of anthropogenic disturbance. In southern New Hampshire, nearly all wetlands harbor some invasive species, with purple loosestrife (*Lythrum salicaria* L.) and common reed (*Phragmites australis* [Cav.] Trin. ex Steud), the two most well-known. Reed canarygrass (*Phalaris arundinacea* L.) is another introduced species which has also been recognized as having adverse effects when it becomes the dominant plant species in emergent wetlands.

1.2.3.1 Common Reed (*Phragmites australis* [Cav.] Trin. ex Steud)

Common reed can grow up to 10 feet high in dense stands and is long-lived. *Phragmites* is capable of reproduction by seeds, but primarily does so asexually by means of rhizomes. Recent research has now shown that native and introduced genotypes of this species currently exist in North America.

Common reed can invade marsh and wet meadow habitat to create a monoculture environment that eventually will reduce the diversity of the native plant community by crowding out other species. Typically, this results in a reduced diversity of fish, birds, and other species that rely on marshes. Common reed can grow so densely that vertebrates have a difficult time utilizing the marsh. In addition, common reed can be a fire hazard since the dry stems can fuel large fires.

1.2.3.2 Purple Loosestrife (*Lythrum salicaria* L.)

Purple loosestrife, a herbaceous perennial native to Eurasia, was introduced to eastern North America in the early to mid 1800's and has rapidly spread to reach every state in the U.S, with the heaviest populations found in the Northeast. It is a semi-aquatic species which prefers moist organic soils, fluctuating water levels, and full sunlight, establishing itself in primarily freshwater wetlands. However, its high tolerance to a wide range of environmental conditions and its ability to grow on a variety of substrates enables it to invade a large number of habitats from marshes, bogs, and swamps to disturbed areas such as roadside ditches and construction sites. The absence of a natural predator in North America further enhances its strength and

ability to out-compete native vegetation and form dense monotypic stands within wetlands.

Species characteristics mentioned above, as well as high seed production and dispersion, makes purple loosestrife a serious problem to native plant diversity and wildlife. Through the displacement of native flora and fauna and formation of a monotypic stand, it eliminates viable sources of food, nesting, and shelter for wildlife as well as reducing fish spawning areas and waterfowl habitat. It also reduces wetland recreational opportunities and diminishes agricultural areas by blocking flow in drainage and irrigation ditches.

1.2.3.3 Reed Canarygrass (*Phalaris arundinacea* L.)

Reed canarygrass (*Phalaris arundinacea L.*) is a tall-growing, perennial grass which is widely distributed across the northern states. Reed canarygrass forms dense, highly productive single species stands that pose a threat to many wetland ecosystems. The species grows so vigorously that it is able to inhibit and eliminate competing species (Apfelbaum and Sams 1987). In addition, areas that have existed as reed canarygrass monocultures for extended periods may have seed banks that are devoid of native species. Unlike native wetland vegetation, dense stands of reed canarygrass have little value for wildlife. Few species eat the grass, and the stems grow too densely to provide adequate cover for small mammals and waterfowl. Once established, reed canarygrass is difficult to control because it spreads rapidly by rhizomes.

1.2.3.4 Control Methods

Four methods have been used to control and reduce the spread and presence of invasive species in wetland communities. These methods must typically be used in combination with a carefully-planned multiple year management strategy in order to be effective. Even then, they often cannot eliminate the species entirely, but can be successful in restricting the species to a sub-dominant position in the plant community. The first three methods include mechanical, chemical and environmental control. Biological control of purple loosestrife is also possible, although no such biological control exists for common reed.

Herbicides can be effective, and have been used to control common reed and other invasive species in New Hampshire salt marshes. But, their use can raise health concerns, especially where wetlands intersect residential neighborhoods and developed areas. Two broad-spectrum herbicides, glyphosate and imazapyr, are commercially available and known to control Phragmites effectively when used properly. These two herbicides are considered safe to use in an aquatic environment.

Mechanical removal involves cutting or plowing or grading of the impacted wetland. It is generally most practical and effective in areas with small pockets or stands of purple loosestrife or common reed. Prior to 1997, mechanical removal was common; however it does require a substantial investment of labor, its short-term effectiveness has not always met expectations, and it often requires maintenance.

Mechanical treatments can be used most effectively following an herbicide treatment to remove dead stems and promote native plant growth. This also aids in the identification of new invasive growth for subsequent herbicide spot treatments. When burning is not feasible, mechanical treatment is recommended.

Prescribed fire is a tool that can be used after an herbicide treatment to remove excess biomass, potentially kill any living rhizomes and promote native plant growth. In situations where prescribed fire can be implemented it is easier to locate Phragmites regrowth and spot-treat those plants with herbicides once a site has been cleared of the thick, dead stems. In situations where it can be implemented safely and effectively, prescribed fire is a cost-effective and ecologically sound tool to help control Phragmites. Prescribed fire is recommended where Phragmites exists in large dense stands. Use of prescribed fire without first treating with herbicides does not control Phragmites, and instead may encourage rhizome growth and cause Phragmites populations to become more vigorous (Michigan DEQ, 2008).

Environmental control involves decreasing the vitality of the invasive population by manipulating certain elements of the surrounding environment such as soil moisture (e.g., temporary flooding) and pH, or the amount of sunlight through the over-story. This has proven to be effective in controlling loosestrife in two NHDOT mitigation sites in the state (Littleton and Nashua), but it must be used in combination with other techniques to be successful in controlling Phragmites.

Biological control of purple loosestrife is achieved through the use of herbivorous insects and is regarded as one of the most efficient, sustainable, and cost-effective strategies to date as a means of reducing the species to a level where it is still present but not dominant within a wetland system. The insects remain in the wetland system indefinitely making long term control possible. In 1992, the US Department of Agriculture (USDA) approved four insects native to Europe to use in the United States that solely rely on purple loosestrife for their food source. These include two species of beetle (*Galerucella calmariensis* and *G. pussilla*) and two species of weevils (*Hylobius transversovittatus* and *Nanophyes marmoratus*). Stunting purple loosestrife by feeding on foliage, terminal buds, and stem tissue, preventing sexual reproduction and seed production, and causing extensive root damage are all characteristic of these species feeding regimes, thus allowing native species and wildlife habitat to be restored.

In 1997, NHDOT and New Hampshire Department of Agriculture, Market, and Food (NHDAMF) worked together to start a pilot study on using biological methods to control purple loosestrife in New Hampshire. Sites were selected among NHDOT mitigation areas based on purple loosestrife population size and density, lack of standing water for the growing season, and accessibility. Both species of beetle (*Galerucella calmariensis* and *G. pussilla*) were selected due to previous success rates in other states, cost, and easy establishment at sites. Monitoring occurred during the growing season and developmental stages of the beetles and included visual assessments of plant populations, quantifying percent-feeding damage, documenting any negative impacts that the beetles have upon native plant species, noting any

predation of the leaf-feeding beetles. In the spring of 1999, an Integrated Pest Management grant was awarded to DAMF to develop a Community Purple Loosestrife IPM Project (Durkis, 2003). As of 2004, the project had resulted in approximately 217,000 beetles being purchased for release into wetlands invaded with purple loosestrife throughout the state, including all ten counties with the incorporation of the NHDOT mitigation sites. More information on this approach can be obtained by contacting Mr. Doug Cygan at the DAMF.

1.2.4 Installation of Water Quality BMPs

It is well understood that increased urbanization is associated with stormwater runoff pollution. Urban runoff pollutants are many and varied depending on the land uses and pollutant sources present in an urban area. Typically, loadings of urban pollutants are greatest from industrial and commercial areas, roads and freeways, and higher density residential areas. Major categories of urban pollutants include sediments, nutrients, microbes, and toxic metals and organic compounds. Additionally, farming can contribute to sediment and nutrient pollution due to the effect of fertilizers, and livestock wastes.

Structural Stormwater BMPs in NH

Stormwater Ponds
- Dry Extended Detention Pond With Micropool Wet Pond
- Wet Extended Detention Pond
- Multiple Pond System
- Pocket Pond

Stormwater Wetlands
- Shallow Wetland
- Extended Detention Wetland
- Pond/Wetland System
- Gravel Wetland

Infiltration Practices
- Infiltration Trench & Drip Edge
- Infiltration Basin
- Dry Well
- Permeable Pavement

Filtering Practices
- Surface Sand Filter
- Underground Sand Filter
- Bioretention System
- Tree Box Filter
- Permeable Pavement
- Flow-through Treatment Swale

Vegetated Buffer (Vegetated Filter Strip)
- Residential or Small Pervious Area Buffer
- Developed Area Buffer
- Buffer on the Downhill Side of Roadway
- Ditch Turn-out Buffer

Source: *NH Stormwater Manual, NHDES, December 2008*

One of the key functions of a wetland system is its ability to serve as a sink for sediments and nutrients, and the uptake of metals by wetland vegetation has been clearly demonstrated. For these reasons, wetland restoration almost always improves water quality in the areas downstream of the project. However, in many cases, the discharge of excessive sediment and nutrients can have an adverse effect on the wetland itself, impacting its ability to provide other important functions. Therefore, an appropriate restoration technique is the construction of stormwater quality best management practices (BMPs) outside of the wetland. The purpose of the BMP installation is to capture the non-point source pollution before it enters the wetland or surface water.

Rapid advancement in the design of stormwater BMPs has occurred over the last decade as the focus on limiting non-point source pollution has increased. Traditional stormwater BMPs focused on detaining runoff and treatment by the use of vegetated swales. However, newer BMPs have better pollutant removal efficiencies than these older approaches. With the release of an updated New Hampshire Stormwater Manual by NHDES in December 2008, a number of new BMPs are now accepted. These can include a number of different structures including "gravel wetlands," "infiltration tranches," "sand filters" and other structures which are intended to mimic natural systems and to encourage infiltration of stormwater rather than direct discharge to wetlands or surface waters. In many cases, installation of

these types of BMPs at the interface of the upland and wetland can help restore the overall ecological integrity of the wetland system.

1.3 Implementing a Wetland Restoration Project

The process of planning, designing and implementing a wetland restoration project can take time and involves several steps, outlined in this section.

1.3.1 Restoration Goals

The first step in any wetland restoration involves establishing goals for the project. This usually involves one or more of three types of goals: 1) wetland area goals; 2) ecosystem function and value goals; and 3) and ecosystem structure goals.

The area goals for wetland restoration projects are generally defined by the extent of an existing impact that is to be restored or created. The conceptual restoration plans developed for certain sites as part of this project, for example, always provide a target area goal. This goal should be interpreted carefully – it is based on a quick field review and review of mapped site conditions. The areas shown on the concept plans are very preliminary and will generally be the maximum amount of restoration or creation possible for a given site.

Ecosystem function and value goals include providing beneficial qualities such as flood flow alteration, pollutant attenuation, wildlife habitat, or recreation opportunities. These goals will generally be tied to replacement of lost wetland functions and values. In the case of the ARM Fund, these lost functions and values are directly tied to the functions and values lost as a result of the projects that contributed to the fund. In most cases, functional goals will be determined by the nature of the site – it is usually feasible to restore the previously lost functions when the restoration site was drained or filled.

Ecosystem structure goals include the establishment and distribution of broad wetland community types, such as forested, scrub-shrub, and emergent wetlands, as well as the species compositions, abundance, and/or survivorship targets within those broad types. Ecosystem goals are often based on the characteristics of nearby reference wetlands with environmental conditions similar to those of the planned wetland. Some goals may take decades longer to achieve than the typical wetland monitoring period of five years or less, so the goal may be limited to starting the wetland on a successful trajectory that is predicted to lead to the desired results.

1.3.2 Site Selection and Baseline Data

Site selection is closely related to the project goals, landscape context, and available hydrology. A wetland primarily intended for floodflow alteration and water quality improvement may be targeted functions in a developed area, whereas one intended primarily for wildlife habitat may be better sited away from development. The

source and quality of water used to achieve the desired wetland hydrology is a critical factor in site selection. The presence of a large wetland or surface water directly adjacent to the project provides relative assurance that adequate hydrology is present, whereas construction of a groundwater based system may require a detailed water budget analysis. Degraded water inputs, such as untreated stormwater from areas with fertilized lawns, pet wastes, and paved surfaces can encourage the growth of unfavorable species and should be avoided unless the wetland is specifically designed and constructed to handle those inputs. Other landscape related factors, such as the presence nearby of favorable or unfavorable species, equipment access, and the likelihood of success all play a role in site selection.

Once the site is selected, baseline data should be collected at the site as well as nearby reference site(s), if available. Typical baseline data include information on topography, soils, vegetation, and hydrology as these are that environmental factors that are manipulated during wetland construction. Additional data on wetland functions and values is often collected from the reference sites.

1.3.3 Design and Implementation

Wetland restoration involves (re-)creating a landscape configuration that will result in the desired hydrology and ecological community for the site. Wetland construction designs generally utilize a topographic base plan to depict existing and proposed grading as well as detailed planting zones with various hydrological regimes.

Wetland design is typically conducted in two phases. First a conceptual design is developed with the major goals and objectives determined. The conceptual design is reviewed by regulatory and sponsoring agencies, which may provide input on the final design. Once all stakeholders are in agreement, a final design is submitted for regulatory approval and contractor bidding. NHDES rules provide a list of required plan elements for wetland restoration or creation as included in following excerpt:

> ***Env-Wt 805.03 Plans for Wetland Restoration or Creation Projects.***
> *The applicant shall include the following in the [project] plans:*
>
> *(a) Existing and proposed grades, with critical and typical cross sections showing:*
>
> *(1) Existing and proposed grades;*
>
> *(2) Predicted water fluctuations; and*
>
> *(3) Proposed wetland cover types for the mitigation area;*
>
> *(b) Construction procedures and timing as follows:*
>
> *(1) The name of the qualified professional responsible for oversight of the mitigation work;*
>
> *(2) The proposed contingency measures for unexpected issues; and*
>
> *(3) The timing and sequence of events;*

(c) A planting proposal, with preference given to native wetland plants and natural communities with localized genetic material, as follows:

(1) Plant species and quantities;

(2) Source of planting materials or whether the plan relies on natural re-vegetation;

(3) Plant stock size and zones of predicted plant occurrence;

(4) Plant survival goals;

(5) The proposed locations of native plant stock and the rate and type of seeding;

(6) When and where seeding or planting will take place; and

(7) Notation of dead snags, tree stumps, or logs per acre, where appropriate, to provide structure and cover for wildlife and food chain support;

(d) Documentation of existing and proposed soils as follows:

(1) The existing soils on the proposed mitigation site;

(2) The source of soils to be placed on the site;

(3) The likely seed bank composition of soils;

(4) The depth of proposed growing medium; and

(5) The soil properties such as texture and organic content;

(e) Erosion control notes and details to minimize or prevent sediment from entering adjacent, undisturbed wetlands or surface waters;

(f) Invasive species in the vicinity;

(g) If applicable, an invasive species control plan; and

(h) Activities that will be allowed and not allowed within the restoration or creation area.

Construction is most often accomplished by hiring an outside contractor, although NHDES and the NH Fish and Game Department have construction equipment and crews which are capable of implementing many of the restoration techniques described in Section 1.2.

1.3.4 Monitoring, Reporting and Adaptive Management

Typically the construction and post-construction phases of the project are monitored to help assure project success. Monitoring of project implementation includes checking grades, hydrology, topsoil quality, erosion controls, proper quality and quantities of planting materials, and planting methods.

Post-construction monitoring involves assessing whether or not the project meets the intended goals and measurable success criteria, or is on a trajectory to meet those targets. It often includes assessments of achieved functions and values, vegetation establishment, hydrology, dominance by wetland vegetation, the presence of invasive species, erosion controls, and the need for any remedial measures.

Typically post-construction monitoring is conducted once or twice per year for three to five years, with annual reports submitted to regulatory and sponsoring agencies. The new wetland is likely to be undergoing natural changes in community structure by the end of the monitoring period, but it should be a self-regulating and self-sustaining dynamic ecosystem that needs no further human intervention.[4] In particular, NHDES administrative rules provide guidance on evaluating the success of restoration and creation sites. Specifically, Env-Wt 806.02(b), Annual Monitoring Report, requires that:

> *…the annual monitoring report shall document that the hydrology of the mitigation site(s) is appropriate and the area has a 75% success rate of coverage of non-invasive hydrophytic vegetation after 3 full growing seasons following completion of the mitigation work or following additional remedial measures...*

In certain cases, the monitoring of a restoration site can be part of an adaptive management approach. Because of the complexity of natural systems, the outcome of even a well-conceived restoration plan can be difficult to predict. **Adaptive management** is particularly useful approach to cope with the complexity of natural systems, and is based on establishing indicators, systematically trying interventions, monitoring their effects and learning from the ecological response of the system. An adaptive management approach recognizes that future changes to the restoration plan may be necessary to maximize results, and ensures that the appropriate resources are included in the project.

[4] Structures such as weirs, dams, stand pipes and similar items, while sometimes necessary, should be avoided in wetland creation or restoration sites, particularly if those structures require maintenance and/or need to be seasonally adjusted to properly operate.

2

Development of a Wetland Restoration Assessment Model

In order to identify and prioritize potential wetland restoration sites in the Merrimack River Watershed, a "Wetland Restoration Assessment Model (WRAM)" was built, consisting of two components: the "Site ID Model" and the "Site Prioritization Model." The Site ID Model was used to identify candidate wetland restoration sites and the Site Prioritization Model was used to assess which of those sites would result in significant environmental benefit and would thus be considered high priority. Both models were developed using GIS data with ESRI® ArcGIS tools and Model Builder software.

In combination, the two models were used to generate a GIS data set of potential wetland restoration sites, categorized according to their potential benefit to the watershed. The basis for the WRAM is explained in detail in this chapter. The model output was then used to select priority sites for further investigation including conducting site visits and development of conceptual wetland restoration plans.

2.1 Watershed Geodatabase

VHB assembled available natural resource and land-use information to create a geodatabase that formed the basis of the WRAM. The GIS was developed using ESRI ArcGIS 9.2, and contained relevant natural resource and infrastructure data from GRANIT, NHDES, the NH Fish and Game Department (NHF&G), the NH Department of Resources and Economic Development (NHDRED), the Society for the Protection of NH Forests (SPNHF) and the Nature Conservancy (TNC), as well as relevant data provided by several watershed communities.

A combined wetland data layer was created by dissolving National Wetlands Inventory (NWI) data with poorly and very poorly drained soil units as contained in the Natural Resource Conservation Service's (NRCS) digital soils mapping. This data layer formed the basis of the identification and prioritization of sites and is referred

to as the "Composite Wetlands." Rectification of the boundaries of the Composite Wetlands to topographic information was completed for a subset of wetlands, most notably the "Priority Sites." It is recognized that the process used to develop the Composite Wetland data does not capture all of the jurisdictional wetlands in the watershed, but the identification of additional wetlands was not within the scope of the project.

2.2 Site Identification Model

2.2.1 Methodology

The purpose of the Site ID Model is to identify impacted wetlands that could serve as a set of candidate sites for input into the Site Prioritization portion of the WRAM. The Site ID model is relatively straight forward, and involved a basic screening method as follows.

In order to be included in the set of Candidate Sites, a Composite Wetland must meet the following criteria (See **Tables 2-1** and **2-2**):

1. Some portion of the wetland is identified by the National Wetlands Inventory (NWI) as having one or more of the following Cowardin, et al. (1979) special modifiers:

   - "d" = partially drained/ditched;
   - "h" = diked/impounded; or
   - "x" = excavated.[5]

2. Any portion of the wetland intersects an area mapped as "Agricultural" or "Other/Disturbed" land cover classifications using the most recent NH Land Cover Classification coverage (Justice, et al. 2002). Specifically, the following cover classes were included in this screening:

   - Barren lands,
   - Orchard,
   - Other agriculture,
   - Hay/pasture or row crop
   - Disturbed land
   - Other cleared lands

3. Finally, Candidate Sites less than five acres in size were excluded. This criterion was based on a review of the literature which suggests that restoration success is most likely when working in or adjacent to wetlands at least five acres in size.

[5] Note that the Cowardin classification system does contain other Special Modifiers that could be diagnostic of impacted wetlands. However, these other modifiers are not used in the Merrimack River Watershed.

VHB conferred with NHDES and the Technical Advisory Group to refine the Site ID Model to ensure that an acceptable study set was generated. It is also important to note that the Site ID Model was not the sole method used to identify Candidate Sites.

GIS data from state and federal sources were used to construct the model and are presented in **Table 2-1**. The individual model inputs were evaluated based on the value of specific attributes of the source data, as presented in **Table 2-2**.

Table 2-1. Site ID Model Base Data

Model Input	GIS Data Source	Data Type	Scale	Data Provider –Date
		Vector	1:12,000	NRCS – 1965, 1968, 1973 1981, 1985, 1993, 2008* (Preliminary)
Land Cover	NH Land Cover Assessment	Raster	30-Meter	NH GRANIT – 2001
NWI Wetlands	USFWS Wetlands	Vector	1:24,000	US Fish and Wildlife Service
NHB Data	Exemplary Natural Communities, Low Condition Score	Vector	1:24,000	NH Natural Heritage Bureau

2.2.2 Site ID Model Results

The final product of the site identification model was a GIS dataset consisting of 906 polygon features that represent potential restoration sites. In addition to the 906 sites identified by the Site ID Model, the NH Natural Heritage Bureau (NHB) provided an additional 45 sites from their exemplary natural community database. These sites were identified by NHB as having a low "condition score," which was assigned based on their assessment of the wetland and which indicates some level of possible impairment.

The resulting set of 951 "Candidate Sites" occupies approximately 9,771 acres (15.3 square miles) within the watershed. Potential sites ranged in size from the minimum value of 5 acres to a maximum of 101.6 acres with a mean site area of approximately 10.6 acres. These sites are distributed among the 65 of 73 towns located in the watershed as shown in **Table 2-3**. Maps showing all of the 951 Candidate Sites are included in **Appendix B**.

Table 2-2. Site Identification Model Attributes

Input/Data Source	Attribute	Potential Values	Potential Site
NWI Wetlands	NWI Type	E – Estuarine	No
		L – Lacustrine	No
		P – Palustrine	Yes
		R – Riverine	No
NWI Wetlands – Modifiers	NWI Code (last digit of field)	b – Beaver	No
		r - Artificial Substrate	No
		s – Spoil	No
		h - Diked/Impounded	Yes
		f – Farmed	No
		d - Partial Drained/Ditched	Yes
		x – Excavated	Yes
NRCS Hydric Soils[1]	Hydric	Y	Yes
		N	No
NH Land Cover Assessment	Land Cover Class	110 Residential/Commercial/Industrial	No
		140 Transportation	No
		211 Row Crops	Yes
		212 Hay/Pasture	Yes
		221 Fruit Orchards	Yes
		412 Beech/Oak	No
		414 Paper Birch/Aspen	No
		419 Other Hardwood	No
		421 White/Red Pine	No
		422 Spruce/Fir	No
		423 Hemlock	No
		424 Pitch Pine	No
		430 Mixed Forest	No
		440 Alpine	No
		500 Water	No
		610 Forested Wetland	No
		620 Open Wetland	No
		630 Tidal Wetland	No
		710 Disturbed	Yes
		720 Bedrock/Veg.	No
		730 Sand Dunes	No
		790 Other Cleared	Yes
		800 Tundra	No

Note:
1 Soils with null values were not considered hydric

Table 2-3. Site Identification Results by Watershed Community

Town/City	Total Area (Acres)	Number of Sites	Area of Sites (Acres)	Percent of Town
Allenstown	13,167	13	110.7	0.8%
Alton	9,429	3	21.8	0.2%
Amherst	22,025	33	306.1	1.4%
Atkinson	7,259	4	24.9	0.3%
Auburn	18,438	37	179.1	1.0%
Barnstead	28,759	28	203.7	0.7%
Bedford	21,156	33	325.4	1.5%
Bennington	221	1	0.0	0.0%
Boscawen	10,792	13	144.7	1.3%
Bow	18,269	14	112.5	0.6%
Candia	7,166	7	70.7	1.0%
Canterbury	28,697	26	269.5	0.9%
Chester	4,157	2	20.0	0.5%
Chichester	13,628	12	114.1	0.8%
Concord	36,500	50	555.4	1.5%
Danville	5,575	8	77.6	1.4%
Deerfield	6,592	2	12.1	0.2%
Deering	12,813	8	58.0	0.5%
Derry	22,731	29	365.7	1.6%
Dunbarton	20,005	23	187.7	0.9%
East Kingston	3,144	9	122.5	3.9%
Epsom	22,153	29	245.4	1.1%
Francestown	19,315	9	106.9	0.6%
Franklin	7,100	5	62.6	0.9%
Gilmanton	35,438	26	254.7	0.7%
Goffstown	24,065	12	127.3	0.5%
Greenfield	8,181	3	25.4	0.3%
Greenville	2,508	2	33.3	1.3%
Hampstead	8,170	11	90.7	1.1%
Henniker	3,300	2	14.5	0.4%
Hollis	6,186	9	58.2	0.9%
Hooksett	23,761	18	192.8	0.8%
Hopkinton	4,787	9	75.6	1.6%
Hudson	18,780	29	341.5	1.8%
Kensington	699	4	32.1	4.6%
Kingston	9,744	16	120.3	1.2%
Litchfield	9,784	26	352.1	3.6%
Londonderry	26,958	40	379.0	1.4%
Loudon	29,897	45	428.4	1.4%
Lyndeborough	19,370	10	83.5	0.4%
Manchester	22,355	38	377.6	1.7%
Merrimack	21,412	15	122.6	0.6%

Town/City	Total Area (Acres)	Number of Sites	Area of Sites (Acres)	Percent of Town
Milford	14,440	14	173.7	1.2%
Mont Vernon	10,820	7	51.8	0.5%
Nashua	12,673	14	232.4	1.8%
New Boston	27,654	15	114.8	0.4%
New Durham	412	1	6.1	1.5%
New Ipswich	14,603	16	206.8	1.4%
Newton	6,365	4	24.4	0.4%
Northfield	7,849	2	16.2	0.2%
Northwood	8,556	8	58.9	0.7%
Pelham	17,151	47	724.7	4.2%
Pembroke	14,597	17	177.7	1.2%
Pittsfield	15,555	23	190.3	1.2%
Plaistow	6,790	15	99.6	1.5%
Salem	16,569	44	448.6	2.7%
Salisbury	6,869	6	72.8	1.1%
Sandown	1,615	2	6.2	0.4%
Seabrook	228	1	0.5	0.2%
South Hampton	5,147	7	71.4	1.4%
Strafford	9,200	6	44.7	0.5%
Temple	13,477	11	80.8	0.6%
Weare	37,357	21	252.0	0.7%
Wilton	15,483	13	112.2	0.7%
Windham	17,772	12	112.6	0.6%

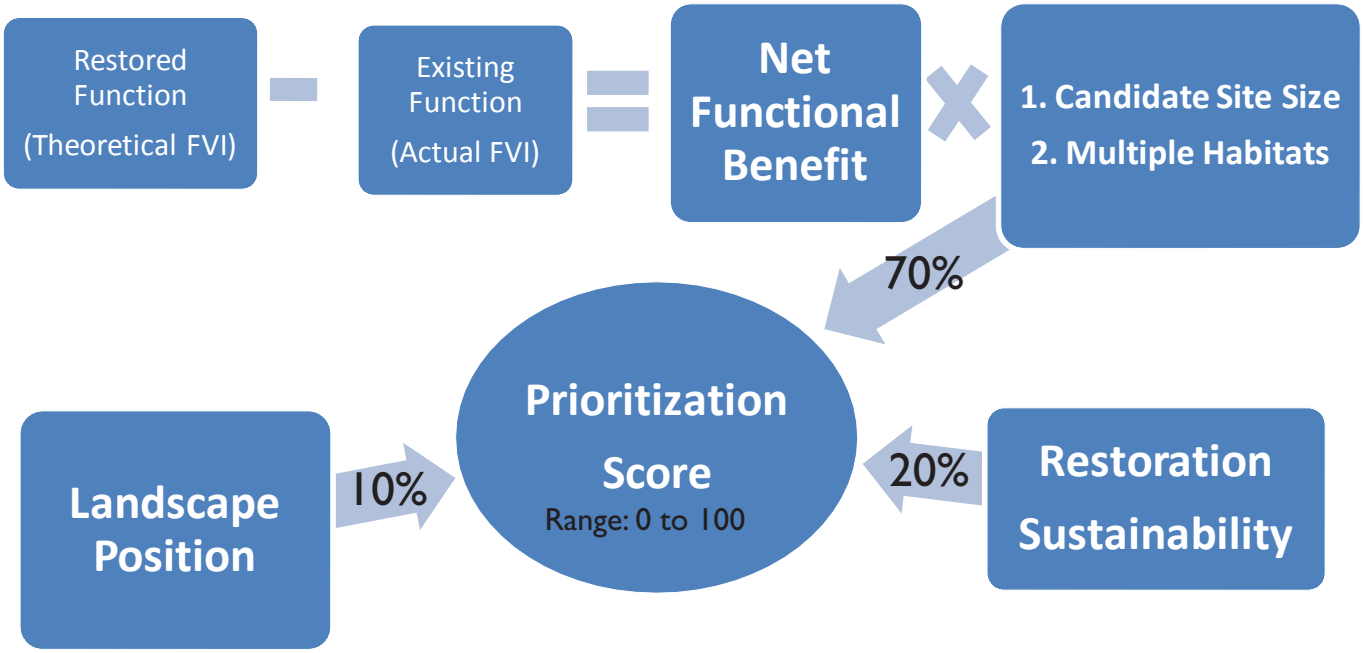
2.3 Site Prioritization Model

2.3.1 Methodology

The purpose of the Site Prioritization Model is to categorize each of the Candidate Sites according to its potential benefit. It comprises three components which calculate the following quantities for each of the 951 Candidate Sites:

- **Net Functional Benefit**, which attempts to measure the amount of wetland function and value that could be gained by restoration of a particular site;
- **Sustainability**, which attempts to measure the likelihood that a site, once restored, will retain increased function over the long-term; and
- **Landscape Position**, which assigns value to sites which are located in certain locations which would be of benefit to the restoration (e.g., close to existing conservation land, higher in the watershed).

These three components are weighted independently to derive a final prioritization score that could range from a value of 0 (low priority) to 100 (very high priority). **Figure 2-1** provides an overview of the model.



Source: Vanasse Hangen Brustlin, Inc.

Figure 2-1

Wetland Restoration Assessment Model
Site Prioritization Model Schematic

Merrimack River Watershed
Wetland Restoration Strategy

0.1 would indicate a low functioning wetland, and score of 1.0 would indicate a high functioning wetland. **Figure 2-2** outlines the functional evaluation method.

Calculating Net Functional Benefit

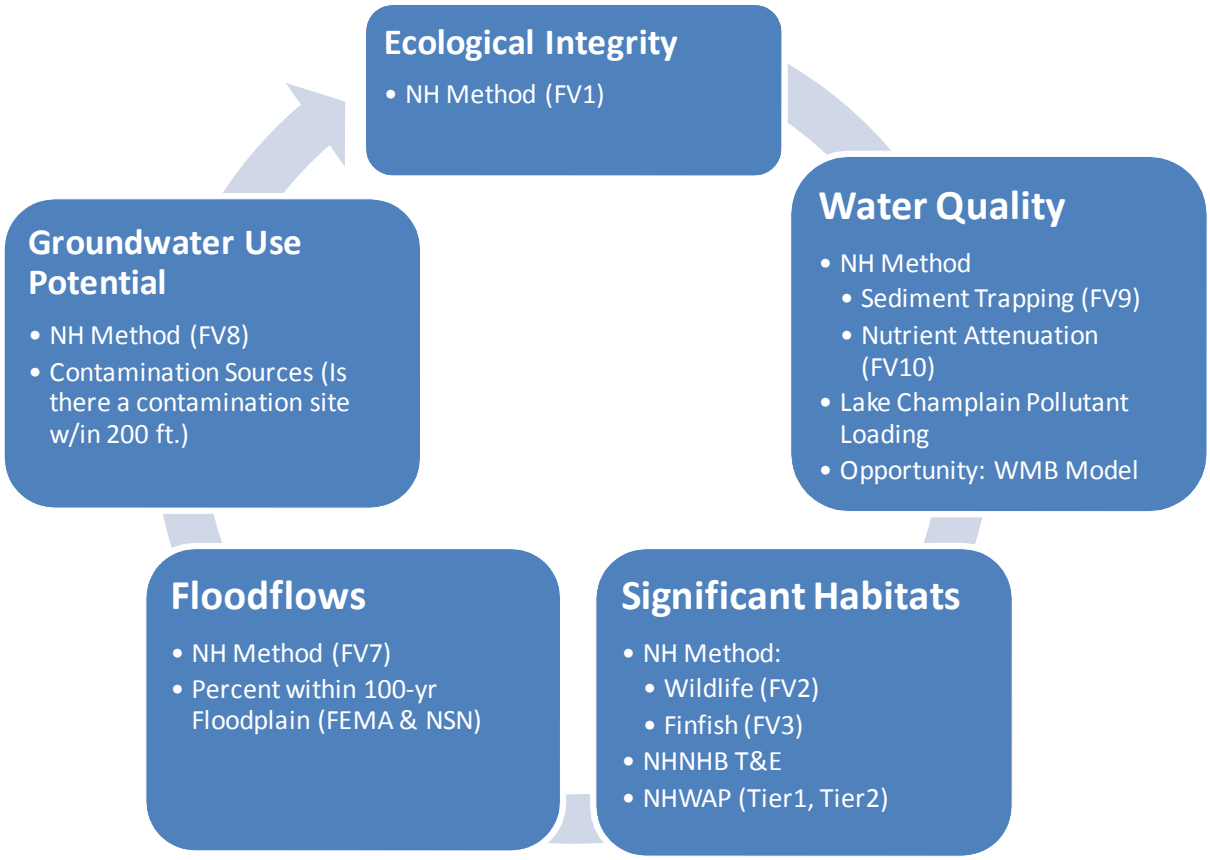
In order to calculate the "Net Functional Benefit," defined as the total amount of wetland function and value that would be created through the restoration of a particular site, it was necessary to evaluate both the existing wetland system and the restored wetland. Obviously, the only system observable was the existing wetland. The "restored" wetland functional evaluation, therefore, is a hypothetical estimate of the total function if the site were to be restored. Calculating this quantity involved the following assumptions:

- *For each function, it was assumed that the restored wetland would score a 1.0 for any component that is subject to restoration;*
- *Each of the components for each function was evaluated by a wetland ecologist and was determined either to be subject to restoration or not subject to restoration.*

To illustrate this process, consider the "Ecological Integrity" Function, which was assessed using the NH Method. This particular function is scored by answering a total of twelve questions, ten of which can be addressed using GIS analysis. Of these ten questions, it was determined that six questions measure parameters that could be modified through restoration. **Table 2-4** summarizes these questions and indicates which were considered to be subject to restoration.

Thus, each of the ten parameters/questions was for evaluated for every wetland in the set of 951 Candidate Sites to compute score for the "Existing Condition." (See **Appendix C** for a detailed discussion of how the GIS model addressed each.**)** Then, a "Restored Condition" score was computed by setting the six questions to 1.0, and a new average "Functional Value Index" calculated. The difference between the Existing and Restored scores, known as the "Net Functional Benefit" was interpreted to be a measure of how much functional benefit could be derived if the Candidate Site was restored in total to eliminate all impairments. Obviously, this simplifying assumption cannot be met in every case, so the Net Functional Benefit must be interpreted to be a theoretical maximum benefit. The actual amount of functional benefit will be dependent on the restoration methods used for a site, and the success of those methods.

Once the Net Functional Benefit was calculated, it was weighted by the size of the candidate site (i.e., larger sites will provide a greater amount of function) and the diversity of the site (measured in terms of the number of NWI classes present in the system). Finally, a weighting factor of 70 was applied such that the NFB score made up 70% of the total "Prioritization Score."



Source: Vanasse Hangen Brustlin, Inc.

Figure 2-2

Wetland Restoration Assessment Model
Functional Evaluation Components

Merrimack River Watershed
Wetland Restoration Strategy

The methodology for this model was fashioned through a collaborative process using a Technical Advisory Group (TAG) comprising various state agencies, regional planning commissions, and nonprofit groups.

2.3.1.1 Net Functional Benefit Score

Of the three components comprising the Site Prioritization Model, the Net Functional Benefit (NFB) evaluation forms its foundation. The evaluation is based on a modification of the *Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire* (Ammann & Lindley-Stone, 1991), but also incorporates other elements. The "NH Method" is a well-established and recognized tool that was developed to assist public officials and the greater community in evaluating wetlands at the community or watershed level. The NH Method takes a scientific approach to evaluate 14 Functional Values of wetlands including ecological integrity, wildlife habitat, nutrient attenuation, flood storage and other values.

The TAG reviewed each of the fourteen Functions and Values recognized by the NH Method to set aside those that could not be accomplished without physically viewing each site and identify those that could be answered using GIS technology. In addition, the TAG identified other sources of data from more recent studies that could be incorporated into the NFB Evaluation. For example, the Wildlife Action Plan (WAP) developed by NHF&G contains valuable information on wildlife habitats. The following list summarizes five key elements of the Functional Evaluation (see also **Figure 2**):

Function:	**Ecological Integrity**
Component:	NH Method (FV1)
Function:	**Significant Habitats**
Components:	NH Method, Wildlife (FV2) NH Method, Finfish (FV3) NHNHB Threatened & Endangered Species Database NH Wildlife Action Plan
Function:	**Flood Protection**
Components:	NH Method (FV7) & FEMA Floodplain Data
Function:	**Groundwater Use Potential**
Components:	NH Method (FV8) & NHDES Contamination Sources
Function:	**Water Quality**
Components:	NH Method Sediment Trapping (FV9) NH Method Nutrient Attenuation (FV10) Pollutant Loading Model (Lake Champlain Adaptation) Pollutant Loading Opportunity (NHDES, WMB Model)

The scoring system for the Net Functional Benefit Evaluation follows the NH Method, which assigns a score for each component on a scale of 0.1 to 1.0. A score of

Table 2-4. Ecological Integrity (NH Method)

Question/Parameter and (data source)	Included In Model?	Subject to Restoration?
1) Percent of candidate site having very poorly drained soils and/or open water. (NRCS)	Yes	Yes
2) Dominant land use of the candidate site. (NHLCC 2001)	Yes	No
3) Water Quality of the watercourse, pond, or lake associated with the wetland. (NHDES CALM)	Yes	Yes
4) Ratio of the number of occupied buildings within 500' of the wetland edge. (US Census)	Yes	No
5) Percent of original wetland filled (NHDES Wetlands Permits)	Yes	Yes
6) Percent of wetland edge bordered by a buffer of woodland or idle land at least 500 feet in width. (NHLCC, 2001; Area of forest/idle w/in 500')	Yes	Yes
7) Human activity within wetland as evidenced by litter, bike trails, roads, residences, etc.	No	No
8) Human activity in upland within 500 feet of the wetland edge as evidenced by litter, bike trails, roads, residences, etc.	No	No
9) Percent of wetland plant community presently being altered by mowing, grazing, farming, or other activity. (NHLCC, Ag land w/in composite wetland)	Yes	Yes
10) Percent of wetland actively being drained for agriculture or other purposes. (NWI - x, d modified relative to composite wetland)	Yes	Yes
11) Public road and/or railroad crossings per 500 feet of wetland. (NHDOT Roads database)	Yes	No
12) Long-term stability of the site. (NHDES Dams, NWI – modifiers h, x, b)	Yes	No

Note: Each of these questions is contained within "Functional Value 1 – Ecological Integrity" as described by Ammann and Lindley-Stone (1991)

Appendix C contains a detailed explanation of the scoring for the Ecological Integrity functions, as well as the four other major functions included in the Net Functional Benefit score.

2.3.1.2 Sustainability Score

Restoration Sustainability represents 20% of the Site Prioritization Model. This component is intended to account for the fact that a site may have a high Net Functional Benefit, but may not be sustainable in the long term. For example, urban wetlands can be quite degraded and would therefore be expected to provide a high functional benefit. These same sites, however, may be subject to continued degradation due to stormwater runoff and other factors. Conversely, a site located within an unfragmented landscape, conservation management area, or sites located in areas characterized by NHF&G as being uninfluenced by humans, could be expected to retain its improved function (i.e., be more sustainable), and thus should be given a higher score than a site located adjacent to an urbanized area. The factors used to calculate the Restoration Sustainability score are illustrated in **Table 2-5.**

2.3.1.3 Landscape Position Score

Landscape Position, which represents 10% prioritization score, is the final component of the site prioritization model. This component is made up of two elements: sites located in or within 1,000 feet of an existing conservation easement or publicly owned tract of land, and sites located within the headwaters of the watershed. These components were added to the Site Prioritization Model based on feedback from the TAG to reflect important considerations in selecting important restoration sites.

Table 2-5. Restoration Sustainability Scoring

Element	Data Source	Attribute	Element Score	Sustainability Score
Is the site located within an unfragmented landscape?	NHFG WAP; Unfragmented Blocks	N/A	Percent of Site, Continuous 0 – 1	
Does the site have a high Human2 score (NHF&G WAP)?	NHFG WAP; Peatlands, Marshed250, Floodplain500 NH GRANIT	Human 2 Score	Continuous 0-1	Average of each of the three Element Scores X 20; Range= 0, 6.6, 13.2 to 20
Is the site located within a conservation management area?	Conservation/Public Lands Database	M-Status (1-3A)	Absence or Presence 0 or 1	

Table 2-6. Landscape Position Scoring

Element	Data Source	Attribute	Element Score	Landscape Position Score
Is the site located in or within 1,000 feet of an existing conservation easement or publicly owned tract of land?	NHGRANIT	Presence or Absence	Logical 1 or 0	Average of the two Element Scores X 10; Range = 0, 5, 10
Is the site located in the headwaters of the watershed?	NHGRANIT	The site must be located in the top 20% elevation for the sub-watershed that the site is located in	Logical 1 or 0	

2.3.2 Calculating the Priority Score

As discussed above, the final "Prioritization Score" ranged from 0 to 100 and was calculated from three distinct parameters:

1) Net Functional Benefit – ranged from 0 (no benefit) to 70 (highly beneficial)

2) Sustainability – ranged from 0 (not sustainable) to 20 (highly sustainable)

3) Landscape Position – ranged from 0 (poor landscape position) to 10 (advantageous landscape position)

These three independent scores were summed to derive the final Prioritization Score for each of the 951 Candidate Sites. The sites were then assigned to one of three categories based on their rank relative to other sites:

- High Priority,
- Priority, or
- Other Candidate Sites

The Prioritization Score and final categorization for each of the sites is shown on the maps in **Appendix B** and detail in the data tables in **Appendix D**.

2.4 Model Evaluation

This section describes the criteria used to ensure that the GIS model would meet project objectives. The data quality objectives and criteria for this project are described in the following sections.

2.4.1 Objective 1 – GIS Data Standards

Objective 1

To develop a comprehensive Geographic Information System for the Merrimack River Watershed by compiling GIS data from existing databases into an ArcSDE Geodatabase.

Acceptance Criteria

To meet data quality objectives, the following acceptance criteria were used to determine whether data would be incorporated into the project GIS:

- Only GIS data of known origin were used. The primary data were from the databases of GRANIT, NHDES, NH Fish and Game, the NH Department of Resources and Economic Development, The Nature Conservancy, and the Society for the Protection of NH Forests. Secondary data sources included regional planning commissions, municipalities and/or other conservation organizations.
- In each case, only the most recent data revision from the original source of the data layer was sought.
- Only data which has been properly documented to Federal Geographic Data Committee (FGDC) standards was used to build the project GIS.

2.4.2 Objective 2 – Model Performance

Objective 2

To use the Geodatabase to construct a geospatial model which will:

- Identify potential wetland and riparian restoration sites (the "Site ID Model"), and
- Prioritize those sites according to the potential benefit to wetland functions and values that would result from their restoration (the "Site Prioritization Model").

Performance Criteria

The GIS model is heuristic in nature; it was not intended to provide an exact solution, and it was understood that iterative changes in the model would be undertaken, if needed, to improve its performance. The model was expected to identify wetland sites that have a high probability of historical impacts that could be reversed by applying restoration techniques. It was also expected to prioritize those wetland sites according to the potential increase in functional value that would result from their restoration. However, the model was not expected to provide an absolute measurement of "restoration suitability" or any other such hypothetical parameter.

Such a heuristic model is appropriate when the model seeks only to rank or categorize according to a constructed score rather than a measureable parameter or characteristic, but is expected to produce a good solution that will contain or intersect with the solution of the more complex problem (i.e., solving for the optimal restoration strategy).

Performance Assessment Methodology & Results

In order to assess the model's performance in identifying potential restoration sites, an independent quality assurance exercise was undertaken to make sure that the model algorithms worked properly. Specifically, without referring to the results of the Site ID model, the consultant project manager, acting as an independent reviewer, selected 20 palustrine wetland sites using the digital National Wetland Inventory for the towns of Bedford, Weare, New Boston and Goffstown. These 20 wetlands were then reviewed using 2005 color digital orthophotography as well as a brief site visit. Based on this review, each wetland was placed in one of two categories: 1) Potential Restoration Site, or 2) Undisturbed/Intact Wetland. In order for a site to be placed in the former category, a clear impairment must have been evident.

Once each site was classified as above, the results of the Site ID Model were reviewed to determine how the model had classified the same sites. This comparison revealed that the independent reviewer classification and the model classification agreed on 17 of 20 sites, for an 85% correspondence. All three sites that were classified differently by the evaluator and the model were sites that the model identified as a candidate site, but which the independent evaluator classified as undisturbed. Based on these results, it was determined that the Site ID model provided a conservative approach to the identification of candidate restoration sites. This was deemed acceptable and significant changes to the Site ID model component were determined to be unwarranted.

Model performance relative to the prioritization of Candidate Sites was also evaluated through a similar process. The preliminary Site Prioritization Model was run for the 951 Candidate Sites. A subset of 16 sites was selected in the towns of Bedford, Goffstown, New Boston and Weare. The consultant Project Manager then reviewed aerial photography of these sites and conducted a brief field visit. Each of the 16 sites was placed into one of three categories: 1) High priority, 2) Default, or 3)

Low Priority. The "default" category was selected unless one or more characteristics made it clear that the site should be considered a high priority or a low priority. The evaluator's classification was qualitative and informal and was based largely on the degree of disturbance/ecological impact that could be viewed in the field or on the aerials. The feasibility of the restoration was also assessed, with hydrological modifications judged to be more feasible than removal of fill or other forms of impact. The position of the Candidate Site in relation to conservation land and/or other undisturbed wetland systems was also considered.

The results of the Site Prioritization Model were then reviewed to determine whether there was correspondence between the Model categorization and those of the evaluator. For this exercise, the model results were categorized as follows: 1) The sites with the 200 highest "Prioritization Scores" were placed in the "High Priority" Category; 2) The bottom 200 sites were considered "Low Priority" and the remaining 551 sites were considered "Default."

Comparison of the Model categorizations and the evaluator's categorization revealed agreement for 11 of the 16 sites, for a correspondence of 69%. There was no clear pattern among the five sites for which categorizations disagreed, although the evaluator classified three of the five sites as "Default" which the model placed in the High Priority category (n=2) or the Low Priority category (n=1). The evaluator categorized two sites as being Low Priority which were categorized by the Model as belonging to the Default category.

While this correspondence was somewhat lower than desired, given the complexity of the concept of "Restoration Prioritization," it was determined that the Site Prioritization Model was capable of producing acceptable results, and the next step in the study was taken – selection of up to 30 high ranking sites for field evaluation.

2.5 TAG Model Review & Refinements

The review of the top sites to select up to 30 sites for field investigation was conducted in an open meeting format with members of the TAG. This meeting provided additional insight into the results of the model which prompted revisions outlined here:

1. The geographic distribution of the high priority sites was non-random. The Model tended to cluster high priority sites in bottomland/floodplain geomorphic settings. Because this is contrary to some of the literature which suggests that headwater wetlands can be important to functions such as base flow and water quality protection, it was decided to add a component to the model that would provide some additional weight to headwater wetlands. (See "Landscape Position" score, described in Section 2.3.1.3 above.)

2. The initial algorithm for calculating the "Significant Habitats" portion of the functional evaluation tended to overweight finfish habitat relative to other parameters. Based on comments from NH Fish and Game, this algorithm

was changed to give greater weight to terrestrial wildlife habitat data from the NH Wildlife Action Plan and rare species data from the NH Natural Heritage Bureau.

3. Comments from the USEPA reviewer indicated that preference should be given not only to sites within defined conservation lands, but to those adjacent to such areas, since these sites represented a potential opportunity to expand the conservation area. Again, a component was added to the "Landscape Position" score to account for this management strategy which gave additional weight to sites that were within 1,000 ft of the boundary of an existing conservation parcel.

Once these refinements were incorporated into the model, a second full model run was completed, which provided the results presented in this technical report and on the project website.

3

Conceptual Restoration Plans

3.1 Selection of Sites for Field Review

Following the results of the Wetland Restoration Assessment Model, the consultant team worked with NHDES, NHFG and the rest of the Technical Advisory Group to select a set of sites to review in the field. The objective of this phase of the work was to develop existing condition and conceptual restoration plans for up to 30 sites in the Merrimack River Watershed. These sites were intended to jump start potential restoration of these systems and to provide examples of restoration projects to watershed stakeholders so as to spur interest in wetland restoration.

The selection of the field study set was initiated during a TAG Meeting in mid-August and finalized the following week in consultation with the NHDES Project Manager. An initial sub-set of 50 sites were reviewed during the selection process. VHB prepared simple maps of each potential site from GIS, depicting an aerial base with resources overlaid, to allow for a desktop review of field conditions by the TAG.

Candidate Sites were excluded from the field study set if significant impairments were not readily discernable based on review of the aerial mapping data. For those sites that were excluded, this was often the case when the only impairment was the presence of an impounded wetland system. An effort was made to ensure that sites were distributed throughout the watershed, and to include a diversity of restoration types.

It is very important to understand that, due to the limitations of GIS, *the model cannot identify or assess <u>all</u> potential restoration opportunities*. While the results suggest that there are numerous opportunities throughout the watershed, and that the model does a good job of identifying those opportunities, it is also clear that local Conservation Commissions and other local and regional organizations may know of other viable wetland restoration sites that are not included in this study and which do not appear on these maps. The exclusion of these sites should not be taken as evidence that such a site would not qualify for an ARM grant or other funding sources.

3.2 Field Review Procedures

The objective of the field review was to gather the field information needed to develop a conceptual restoration plan, including:

- Existing use/disturbance of site;
- Soils – planting medium;
- Compatibility with surrounding land use;
- Landscape position;
- Adjacency to undisturbed riparian wetland systems;
- Exemplary natural communities or individual RTE occurrences; and
- Surface water runoff/hydrological input.

Specific information collected during the field work included refined wetland and restoration site boundaries, which were based on field checking of aerial photography. The level of impairment and type of disturbance/degradation (e.g., drained, filled, cropped, urban encroachment) was also noted.

3.3 Conceptual Restoration Plan Elements

Based on data gathered during the field portion of the project, VHB developed a set of simple plans of each site that shows the existing conditions and the potential restoration measures that could be implemented. The intent of the existing conditions map is to represent the existing conditions and identify impairments. The conceptual restoration plan depicts potential restoration measures, including target cover types and habitat features.

Restoration techniques considered in this phase are as follows:

- Creation of grass buffer zones or vegetative filter strips;
- Riparian plantings with trees and other vegetation;
- Restoring historic hydrological conditions by filling or blocking drainage ditches or tile drainage or breaching dikes;
- Creation of small levees and water control devices;
- Livestock exclusion;
- Removal of historic fill or grading to reestablish historic topography;
- Removal of nonnative invasive plants;
- Removal of fish passage barriers such as hanging culverts, dams or other unnatural barriers; and
- In-stream aquatic habitat restoration including creation of riffles, pools, meanders, and woody debris.

In preparing each site-specific restoration plan, the following criteria were considered where information existed to allow evaluation:

- Extent of ecological degradation
- Potential for recovery without intervention
- Potential to meet objectives with restoration measures
- Ecological impacts of construction
- Complexity of construction and access

A preliminary cost estimate was prepared for each of the 30 example restoration sites. Because no engineering design (beyond a very preliminary concept) was completed during this study, cost estimates will be "order of magnitude" or assigned to three or four range categories.

3.4 Description of Conceptual Restoration Sites

A set of plans for the 30 example restoration sites is contained in **Appendix B** and can be accessed on the internet at: www.restoreNHwetlands.com. Conceptual cost estimates for each of these site is provided in **Appendix E**. Below, we provide a brief description of each of the example sites.

3.4.1 Site 5 – Beaver Brook Tributary, Pelham

Description

At more than 100 acres of contiguous wetland area, this site is the largest in the set of 951 Candidate Sites and has a diversity of restoration opportunities. It occupies a low valley created by Marsh Hill and Burns Hill to the south and east, and an unnamed hillside to the north and east. The wetland drains from the east to the west.

Emergent shallow marsh is the dominant cover type, with some deep marsh also present in the eastern portion of the site. The fringes of the marsh, particularly where disturbed by adjacent land uses, tend to be dominated by wet meadow species. Soils are organic throughout.

Dominant plants in the marsh include cattail (*Typha latifolia*) and wool-grass (*Scirpus cyperinus*). Tussock forming species, like tussock sedge (*Carex stricta*) and Canada bluejoint (*Calamagrostis canadensis* var. *canadensis*), also cover broad areas and form a hummock-hollow topography. Phragmites stands were dominant in several areas of the marsh. The deep marsh typically has a mixture of bur-reeds (*Sparganium* spp.), sedges (*Carex* spp.), and rice cut-grass (*Leersia oryzoides*). Duckweed (*Lemna* spp.) was abundant in the excavated ponds. The wet meadows components of the wetland were typically dominated by reed canary grass (*Phalaris arundinacea*) alongside

unidentified sedges (*Carex* spp.). Purple loosestrife was found throughout the marsh as well, either as a dominant or subdominant species.

Impairments

- Several drainage channels have been excavated throughout the system, resulting in lower ground water elevations in substantial portions of the system.
- Suburban land uses are encroaching on the wetland system, principally from the north and east, although some residential development is located to the south.
- Two large ponds have been excavated from emergent marsh in the south central portion of Site 5.
- A buried natural gas pipeline (Tennessee Gas) bisects the wetland from north to south.
- A large crushed stone operation is located on the southwest side of the wetland, although there has been relatively minor impact considering the magnitude of this land use.

3.4.2 Site 6 – Lower Beaver Brook Tributary

Description

This site is located about 1,500 ft downstream of Site 5, on the same unnamed perennial tributary to Beaver Brook. It is part of the broad, flat floodplain wetland system that is contiguous with Beaver Brook and is one of the most significant wetland systems in southern New Hampshire. The tributary flows into the mainstem of Beaver Brook about 2,000 ft downstream.

Soils are largely organic. Two relatively large glacial kame features rise above the adjacent wetland on the north and south sides of Site 6, but no corresponding kettle morphology was observed to occur in the vicinity.

Similar to Site 5, shallow marsh dominates this wetland. Dominant plants in the marsh include cattail and wool-grass, tussock sedge and Canada bluejoint. Phragmites stands were dominant in several areas of the marsh, as were other invasive species such as reed canary grass and purple loosestrife.

Impairments

- Similar to Site 5, several channels have been excavated in this wetland, again lowering groundwater contours in the immediate vicinity.
- There is some urban encroachment on the east side of the wetland with two cemeteries, a roadway and an industrial site all located to the east.
- Fortunately, there is relatively little encroachment on the north, south and western sides of this wetland.
- A stormwater basin empties into the perennial tributary just upstream of Site 6.

- Several invasive species such as Phragmites, purple loosestrife and reed canary grass were dominant in portions of the wetland.

3.4.3 Site 52 – Musquash Brook, Hudson

Description

Site 52 is contained within the larger Musquash Brook system. This portion of the wetland is located south of Bush Hill Road, just west of the boundary between the Town of Hudson and the Town of Pelham. A utility right-of-way runs parallel to the western edge of the wetland. This wetland drains to the south, supporting downstream reaches of Musquash Brook and its associated riparian wetlands.

The northeastern portion of the wetland consists of a mixed graminoid emergent community in the vicinity of the stream inlet. Vegetation includes jewelweed (*Impatiens capensis)*, sensitive fern *(Onoclea sensibilis)*, reed canary grass, sedges, broadleaf cattail and giant goldenrod *(Solidago gigantea)* extending up to the tree line. Speckled alder *(Alnus incana)* occurs in a narrow fringe along the upland tree line, dominated by mixed red maple *(Acer rubrum)*, white pine *(Pinus strobus)* and red oak *(Quercus rubra)* in the overstory. The mixed graminoid community at the stream inlet is a small portion of the areal cover of the entire wetland.

The northern portion of the wetland includes a red maple swamp community, extending south along the eastern boundary in a band approximately 200 feet wide. This community is composed of red maples in the overstory with white pines in the uplands and dead snags along the transition to emergent shallow marsh near the central portion of the system. Understory vegetation consists of silky dogwood *(Cornus amomum)*, arrowwood *(Viburnum dentatum)*, royal fern *(Osmunda regalis)*, sensitive fern, cinnamon fern *(Osmunda cinamomea)*, tussock sedge and jewelweed.

The majority of the wetland, encompassing the western edge and central portion, is composed of a dense, broadleaf cattail-dominated shallow to deep marsh cover type. Sedges, soft rush *(Juncus effusus)* and joe-pye weed *(Eupatorium maculatum)* are subdominant. Moving further south, the vegetated community becomes less dense with spotty areas of standing water, containing water lilies and other aquatic bed vegetation. Highbush blueberry *(Vaccinium corymbosum)* and tussock sedge occur along the fringe with red and white pine, red oak and red maple in the adjacent uplands.

A single residence is closely adjacent to the eastern wetland edge. An excavated pool, which functions as a vernal pool, is located at the forested edge of a mowed back yard with fill material to the edge of the water.

Impairments

- Several channels have been excavated within the wetland, lowering groundwater contours in the wetland.
- Surrounding land use is mainly undeveloped and forested. Minimal residential development occurs adjacent to the northeastern edge.
- A maintained utility right-of-way runs parallel to the western boundary of the wetland.

3.4.4 Site 67 – Second Brook Swamp, Hudson

Description

Site 67 is located at the confluence of the north and south branches of Second Brook, draining across Bush Hill Road and Wason Road, respectively. At almost 108 acres, this is one of the largest sites in the list of Candidate Sites. The area is known locally as "Miles Swamp." The restoration site, which is bordered on the east by the Pasture Drive neighborhood and on the west and south by Glen Drive, is part of a larger system which extends to the north. The restoration site drains north and west to a deep marsh/shallow pond, which outlets to the main stem of Second Brook.

The site contains high interspersion of wetland classes, vegetated communities and water features. Upland islands are also found distributed throughout the wetland system, particularly in the southeastern portion. The patchwork nature of this wetland system makes it valuable habitat to a wide variety of wildlife.

The dominant cover type within Site 67 is emergent shallow marsh dominated by cattail, which may occurs at or near monoculture in most areas, but also is co-dominant with reed canary grass, wool-grass, Phragmites, loosestrife. Emergent cover types generally compose the main body of the wetland but may also be adjacent to peripheral scrub-shrub cover types. A typical mixed community consists of jewelweed, broadleaf cattails, bluejoint grass (*Arctagrostis latifolia*), false hellebore (*Veratrum viride*), sensitive fern, royal fern, sedges, purple loosestrife and giant goldenrod. Some areas toward the center of the system are dominated by reed canary grass with sedges, purple loosestrife, and cattails mixed in. Areas near the periphery may have a higher concentration of jewelweed, while other marginal strips or central patches may nearly be a monoculture of broadleaf cattail.

The southern and eastern portions of the site consist of mixed forest and shrub vegetation. A typical forest community includes red maple dominant in the overstory, bordered by white pine and red oak in the adjacent uplands. Understory vegetation in the wetland includes highbush blueberry, arrowwood, glossy buckthorn, red maple saplings, sedges, royal fern, marsh fern, sensitive fern, cinnamon fern and false hellebore.

Scrub-shrub wetlands are interspersed, often within the forest setting, as dense alder shrub thickets. Sedges and sensitive fern are also common. The riparian area in the

eastern portion of the wetland system consists of a shrub wetland, as well, with dominance by arrowwood, speckled alder, and red maple saplings. Associated ground cover includes false hellebore, jewelweed, sensitive fern and sedges.

Impairments

- Generally, the ecological integrity of the site is relatively good. Human activity within the surrounding uplands and within the wetland itself is minimal.
- However, invasives such as Phragmites, purple loosestrife and reed canary grass are dominant or sub-dominate in the majority of the site.
- Some excavated channels are present within the forested portions of the wetland on the east side of the site.

3.4.5 Site 71 – Salmon Brook Marsh, Nashua

Description

At more than 116 acres, the Salmon Brook Marsh is among the largest wetlands in Nashua. It occupies the floodplain created by the confluence of Hassells Brook with Salmon Brook. Salmon Brook then runs east until it flows into the Merrimack River, about 1,300 lin ft downstream of Site 71. Two structures impound water in the marsh: 1) bike/pedestrian crossing at Chesnut Street contains three culverts appears to impound Salmon Brook, at least during higher flow events, and 2) a dam structure located at the outlet of Site 71 adjacent to the Daniel Webster Highway clearly impounds several feet of water within the marsh.

The site is mapped as a designated Prime Wetland under RSA 482-A by the City of Nashua, and the southeastern portion of the wetland is contained within a conservation easement. These two mechanisms provide additional protection to the site beyond typical state and federal wetland regulations.

Despite the several observed impairments (see below), the Salmon Brook wetland is a relatively diverse system with 13 different NWI cover types configured with a relatively high degree of interspersion. This creates important structural and ecological diversity within the wetland, and is a key factor in making this area one of the most significant remaining natural habitats in Nashua.

The site is dominated by emergent shallow and deep marsh, with vegetative communities similar to other such marshes in southern NH. Soils are largely organic Chocurua Mucky Peat, where they are not flooded by the two impounding structures within the marsh.

Impairments

- The site is surrounded on all sides by urban development.

- Invasive species such as Phragmites, reed canary grass and purple loosestrife are dominant to sub-dominant throughout.
- Several stormwater discharges were noted in the wetland. Based on preliminary review of the adjacent land uses, it is highly unlikely that these discharges are detained and/or treated prior to discharge.
- There are several excavated channels within the wetland, although their effect on the water table may not be significant.
- The wetland is flooded by a dam at the outlet of the system at the Daniel Webster Highway/Main Street.
- A significant portion (almost 1,000 lin ft) of Salmon Brook downstream of Site 71 was buried by previous land development activity. This represents a significant barrier to the upstream and downstream passage of anadromous fish and other aquatic species.

3.4.6 Site 76 – Harris Brook Tributary, Salem

Description

This site consists of a red maple swamp along the floodplain of a perennial tributary to Harris Brook. The tributary drains southerly, crossing under Cross Street, then flowing south along Interstate 93 until it reaches its confluence with the mainstem of Harris Brook about ¾ mile downstream.

The site is mapped as a designated Prime Wetland under RSA 482-A by the Town of Salem (Prime Wetland 26), and a portion of the wetland is contained within a conservation easement. These two mechanisms provide additional protection to the site beyond typical state and federal wetland regulations.

Red maple is dominant in the overstory, and often provides more than 90% of the canopy cover. A variable mixture of tree species co-occurs with red maple, including yellow birch (*Betula alleghaniensis*), white ash, white pine, American elm (*Ulmus americana*). The shrub layer is dense and well-developed. Common shrubs are highbush blueberry and common winterberry (*Ilex verticillata*), which are often dominant, and spicebush (*Lindera benzoin*). The herbaceous layer is variable, but ferns are abundant. Cinnamon fern is common; other ferns include sensitive fern, royal fern, marsh fern (*Thelypteris palustris*), and spinulose wood fern (*Dryopteris carthusiana*). Graminoids are common, mixed with a variety of herbaceous species. Some of the most common herbaceous species are skunk cabbage (*Symplocarpus foetidus*), false hellebore, jewelweed, swamp dewberry (*Rubus hispidus*), marsh marigold (*Caltha palustris*), and the bugleweeds (*Lycopus* spp.).

Impairments

- Residential development encroaches on the southwest and southeast boundaries of the site.

- A series of drainage ditches have been excavated from the swamp in the southern portion, effectively lowering the groundwater contours in a portion of the swamp.

3.4.7 Site 81 - Porcupine Brook, Salem

Description

This site consists of the forested, emergent and scrub-shrub wetlands bordering a branch of Porcupine Brook in the southwestern portion of Salem. The wetland forms the headwaters of the perennial stream, which flows west about 0.9 mile, through the I-93 Exit 1 area, until it flows into the mainstem of Porcupine Brook just southeast of the Rockingham Mall. The wetland is dominated by a forested riparian swamp with red maple the dominant overstory species. Substantial encroachment from an industrial use and a recreational use have substantially affected this wetland. Obviously, restoration of this site, like all others in the study, is contingent upon the willing participation of the property owners.

The site is mapped as a designated Prime Wetland under RSA 482-A by the Town of Salem (Prime Wetland 16), and the central portion of the wetland is contained within a conservation easement – the "Turner Homestead" site. These two mechanisms provide additional protection to the site beyond typical state and federal wetland regulations.

Impairments

- A substantial portion of the wetland appears to have been filled on the north side of the site by the adjacent waste management facility. This filling apparently occurred without a permit from NHDES, but a previous enforcement case was resolved (Mary Ann Tilton, NHDES Wetlands Bureau, personal communication).
- Porcupine Brook has been straightened and deepened along much of its length in Site 81.
- Land use associated with a golf course along the southern boundary of the wetland system has had an impact on the wetland. Impacts include previous fill and disturbance to vegetation associated with periodic mowing.
- Several ponds have been excavated from the wetland, which now serve as water features and irrigation sources for the golf course. Ponds are eutrophic.
- A small number of excavated ditches are present within the wetland, particularly the western half of the site.

3.4.8 Site 134 – Farmed Wetland, Litchfield

Description

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.

Site 134 is located within the floodplain of the Merrimack River and encompasses a large agricultural operation. Areas within this agricultural site are farmed wetlands, while other areas appear to be effectively filled and drained and no longer function as wetlands. The majority of the site is actively maintained cropland. Defining the wetland boundary in this type of landscape is very difficult without close inspection of soils characteristics, so the boundary shown in the existing conditions plan should not be interpreted as definitive, but rather as an estimate of the likely maximum extent of the wetland prior to agricultural conversion.

A small unnamed perennial stream emerges from a pond in the central portion of the site. The stream itself is channelized and highly entrenched. There is a narrow intact shrub/forested buffer along some of the stream consisting of alders and birches, although there are also significant portions of the stream that lack any kind of buffer. The stream flows south for a total length of about 1 mile, about ¾ of which is located within Site 134.

Remnants of an alluvial red maple swamp (sensu Golet, et al. 1993) can be found along the western portion of the site, and provide a sense of the likely pre-settlement community located within Site 134. The overstory of this forested community is characterized by a mixture of red maple and silver maple (*Acer saccharinum*) with lesser amounts of green ash. Red oak (*Q. rubra*), white pine, and black cherry (*Prunus serotina*) occur in elevated sections. The swamp has a well-developed shrub layer composed of northern arrow-wood, silky dogwood, and the non-native plant European buckthorn (*Rhamnus frangula*).

Impairments

- Several areas of wetlands are actively drained or appear to have been filled.
- The perennial stream located in the central portion of the site is deeply entrenched, largely eliminating the connection between the stream and its adjacent floodplain. Erosion of this stream does not appear to be a significant issue however.
- Stream water quality is expected to be very poor given the agricultural use (nutrients) and lack of buffer (temperature).
- The invasive forage plant reed canary grass is dominant throughout many of the emergent portions of the disturbed remnant wetlands.

3.4.9 Site 218 – Nesenkeag Brook, Londonderry

Description

Site 218 is an emergent marsh that, together with an adjacent undisturbed forested swamp, forms the headwaters of Nesenkeag Brook, an important perennial stream which flows east through Londonderry and Litchfield to empty into the Merrimack about five miles east of the site.

The emergent marsh that forms Site 218 is approximately 18 acres in size and is dominated by cattail, with purple loosestrife, Phragmites and wool grass also present. Cattail approaches 90 percent cover in some locations, while extensive Phragmites stands are interspersed.

Impairments

- Substantial evidence of OHRV within the wetland.
- Phragmites and purple loosestrife are dominant.
- Suburban encroachment on the north and south sides of the wetland, although substantial forested buffers exist to the east and west.

3.4.10 Site 231 – Hartshorn Brook, Milford

Description

Site 231 is located in a small valley formed by the hills of Mont Vernon to the north and Christian Hill and Patch Hill in Amherst to the east. Joslin Road is located to the north of the site, Jennison Road to the west, and NH Route 13 to the west. Hartshorn Brook flows south and east through the site, then proceeds to flow southeast about ¼ mile to its confluence with the Souhegan River. Thus, the entire site can be considered tributary to Hartshorn Brook and the Souhegan.

The plant community is dominated by reed canary grass throughout much of the site. Cattail and tussock sedge dominate other, wetter emergent portions of the site. Most of the wetland is actively disturbed by on-going land use associated with the residences on the west side or the agricultural use on the north side. An excavated and impounded farm pond is located in the center of the site.

Impairments

- Reed canary grass dominates a wet meadow habitat is heavily impacted by adjacent land use and human use of the wetland.
- A portion of the farm pond appears be filled.

- There has been some minor encroachment by a commercial use on the southern side of the site.
- Portions of the wetland may be tile drained. Outlets could not be confirmed, but at least one possibly riser was noted in the agricultural field.
- OHRV use appears to be on-going in the northeastern part of the wetland.

3.4.11 Site 273 – Farmed Wetlands, Litchfield

Description

The large wetland site is located in the floodplain of the Merrimack River in Litchfield. Like Site 134 described above, the most significant feature of the site is a large area of farmed wetland. NH Route 3A forms the western border of the site, and a relatively intact red maple swamp lies along the eastern boundary. A portion of the site lies within an easement apparently intended to preserve agricultural use of the area.

The northern portion of the site is currently used to grow corn, while the southern portion of the site is used as a hayfield. Aside from the red maple swamp on the west, the majority of the native wetland vegetation has been removed from the site due to the agricultural activity. The red maple community is similar to the community previously described above for Site 134.

Impairments

- Substantial area of farmed wetland in the northern portion of the site.
- An excavated ditch line drains the southern portion of the site, lowering groundwater contours.
- Some portions of the farmed wetland show evidence of fill.
- Minor residential encroachment on the western side of the wetland.
- Although it could not be confirmed, tile drain lines may be in place within the wetland.

3.4.12 Site 295 – Hoodcroft Country Club, Derry

Description

This site is a large emergent system that surrounds the Hoodcroft Golf Course in Derry. The wetland is supported by flow from Beaver Lake to the northeast via an unnamed perennial stream and from West Running Brook. These two perennial streams meet in the southern part of Site 295, where they proceed to flow south until they join Beaver Brook, about one mile downstream.

The site is mapped as a designated Prime Wetland under RSA 482-A by the Town of Derry (Prime Wetland 13F). This designation provides additional protection to the site beyond typical state and federal wetland regulations.

The majority of the wetland is a deep emergent marsh/shrub swamp, formed in the broad, flat areas bordering low-energy streams identified above. The soils (Scarboro muck, Greenwood and Ossipee soils, and Chocorua mucky peat) typically have a layer of well-decomposed organic muck at the surface overlying mineral soil. There is standing or running water during the growing season and throughout much of the year. Water depth averages between 6 inches and 3 feet.

The dominant plants in this wetland are broad-leaved cat-tail, purple loosestrife and Phragmites, often in dense stands. Other characteristic plants include wool-grass, common threesquare (*Scirpus pungens*), Canada bluejoint, rice cut-grass, and tussock-sedge. Other observed herbaceous species include arrow-leaf tearthumb (*Polygonum sagittatum*), water-hemlock (*Cicuta bulbifera*), swamp-candles (*Lysimachia terrestris*), beggar-ticks (*Bidens* spp.), bedstraw (*Galium* spp.), common arrowhead (*Sagittaria latifolia* var. *latifolia*), slender-leaved goldenrod (*Euthamia tenuifolia*) and marsh-fern (*Thelypteris palustris* var. *pubescens*).

Impairments

- Urban development surrounds the wetland site on its west, south and east boundaries.
- Small fill areas are evident in several places along the margin of the wetland.
- Portions of the wetland have been incorporated into the golf course, and are mowed and landscaped.
- Water quality in open water portions of the site display eutrophic conditions typical of high nutrient loading.
- Purple loosestrife is dominant in much of the wetland, as is Phragmites in parts of the site.

3.4.13 Site 348 – Hog Hill Swamp, East Kingston

Description

This site is occupies a broad, flat valley formed by Hog Hill, Bruce Hill and Martin Hill in the south and west and Morse Hill to the east. It is contiguous with the large forested Hog Hill Swamp on the south and west. The dominant cover type in this wetland, however, is emergent wet meadow dominated by reed canary grass. This community type is not likely native, but is probably due to the use of the wetland as an agricultural field. The hydrology of the area suggests that, if left undisturbed, a shrub or forested swamp would develop.

The most noticeable feature of this site are the numerous, precisely laid out ditch lines that are intended to drain this wetland, but which cannot completely do so. The vegetation appears to be mowed frequently.

Aside from reed canary grass, characteristic species include Canada rush (*Juncus canadensis*), spike sedge (*Eleocharis sp.*), various sedge (*Carex*) species and creeping bent grass (*Agrostis stolonifera*).

Impairments

- Numerous ditches are present throughout the wetland, with a channel having been excavated from the central part of the site.
- Periodic mowing has affected the vegetative community and determines the cover type present in the wetland.
- Reed canary grass, generally considered an invasive species, is the dominant plant throughout much of the wetland area.

3.4.14 Site 366 – Beaver Br Headwaters, Londonderry

Description

This site contains a large emergent marsh which forms the headwaters of Beaver Brook, one of the most significant watercourses in southern NH. Emerging from this wetland, a perennial stream flows west about 1½ miles, across I-93 and NH Route 28, until it joins with Shields Brook near the Derry town line to form Beaver Brook. Beaver Brook then proceeds to flow south through Derry, Londonderry, Windham, Hudson and eventually Pelham, where it crosses the Massachusetts border into Dracut. Site 366 is one of several sites in this study which are tributary to Beaver Brook.

Despite its proximity to I-93, Site 366 has a relatively intact forested buffer dominated by white pine on all sides. The wetland itself is dominated by emergent marsh species such as cattail, wool-grass, Phragmites, and purple loosestrife. The site is located primarily on a parcel known locally as the Reed Clark parcel.

Impairments

- The site is partially drained by a network of excavated channels.
- Invasive species are dominant to subdominant.

3.4.15 Site 371/376 – McQuade Brook, Bedford

Description

McQuade Brook flows through Site 371/376 Flows into Baboosic Brook about ¼ mile downstream (to the south). The site consists of a deep marsh portion to the west of Jenkins Road, and a shallow marsh portion to the east. The western portion is dominated by a beaver impoundment that forms a large shallow pond. Emergent

vegetation includes tussock forming species such as tussock sedge and Canada bluejoint which form hummock-hollow topography. Other dominant plants in the marsh include cattail (*Typha latifolia*) and wool-grass (*Scirpus cyperinus*). Phragmites stands were dominant in several areas of the marsh. Bur-reeds (*Sparganium* spp.), sedges (*Carex* spp.), and rice cut-grass (*Leersia oryzoides*) were also present.

The shallow marsh on the east side of Jenkins Road is dominated by cattail and reed canary grass. To the north, a small perennial tributary meanders among the recent residential development. A small buffer remains in place, but this buffer is less than 25 feet in most places. The wetland along this stream, within the common land associated with the Cabot Preserves development, has been mowed and landscaped.

Impairments

- McQuade Brook has been channelized throughout much of its length in the western segment of the site.
- A discontinued railroad grade runs the length of McQuade Brook and impacts the hydrology of the western segment.
- Residential development of recent filling has begun to encroach on the eastern portion of Site 371/376.
- Invasive species such as purple loosestrife and Phragmites are present.
- Significant portions of the eastern part of the site are mowed periodically.

3.4.16 Site 378 - Riddle Brook Wetlands, Bedford & Merrimack

Description

This site consists of a relatively diverse emergent, scrub-shrub, and forested components at the confluence of lower Riddle Brook and Baboosic Brook. Portions of the system have retained good ecological integrity, while other areas have been impacted by adjacent land use, typically at the margins of the system. The portion of this site in Bedford is designated as Greenfield Farms Open Space.

Because the site spans the municipal boundary between Bedford and Merrimack, cooperation between these two communities would be required to conduct the full program depicted in the Conceptual Restoration Plan developed for this site.

The site is bordered on the north by the relatively new Greenfield Farms residential development. The roadway constructed to serve this development crosses Riddle Brook and its floodplain wetland by way of a large open bottom culvert as well as a series of five floodplain culverts. Dominant species in this portion of the site include those typical of deep marsh habitats including tussock sedge, cattail, and wool-grass. Button bush *(Cephalanthus occidentalis)* is a common shrub species, as are the dogwoods. Red maple and American elm are present in forested portions of the site.

Impairments

- Despite the good efforts to minimize impacts to Riddle Brook resulting from the Greenfield Parkway crossing, there is still a substantial amount of fill in the floodplain, and multiple culverts typically create hydraulic conditions not normally found in floodplain flows. While probably not feasible, replacement of this crossing with a full span bridge structure would eliminate the majority of the impact to Riddle Brook in this location.
- Portions of the scrub marsh on the central portion of the site have been ditched, potentially impacting the groundwater contours in this area.
- Phragmites and purple loosestrife are among the dominant plant species in much of the wetland.
- Residential uses encroach from the north and east of the site.

3.4.17 Site 530 – Piscataquog R. Floodplain, Goffstown

Description

This site lies at the confluence of the mainstem of the Piscataquog River and the south Branch of the Piscataquog in Goffstown. This is a very active floodplain that experiences floodwaters reaching several feet or more quite frequently – in most years where spring flows are at or above the median. From this site, the Piscataquog River flows west through Goffstown and Manchester until it reaches the Merrimack River, about 9 ½ river miles downstream.

Like many other floodplain areas in the Merrimack Watershed, this area has been cleared and is active agricultural use. A blueberry orchard is located adjacent to the site, and the majority of the wetland is used to produce hay. Remnant floodplain channels are evident within the hayfield. The hayfield appears to be nearly completely dominated by reed canary grass. It is likely that the site would revert to floodplain forest similar to the adjacent undisturbed wetlands if the field mowing were discontinued.

The floodplain wetland to the south of site is mapped as a designated Prime Wetland under RSA 482-A by the Town of Goffstown (Prime Wetland 17) which provides protection to the wetland beyond typical state and federal wetland regulations.

Other vegetation observed in the adjacent wetlands includes purple loosestrife, sensitive fern, royal fern, deer tongue (*Dichanthelium clandestinum*), early meadow rue *(Thalictrum pubescens)*, grape (*Vitis* sp.), poison ivy, Virginia creeper, joe-pye weed, barberry, bittersweet, broad-leaf cattail, spirea, speckled alder, musclewood, red maple, willow (*Salix* sp.), American elm, basswood (*Tilia americana*), hemlock, and eastern white pine.

Impairments

- The periodic mowing of the floodplain wetland artificially maintains a wet meadow dominated by reed canary grass. This community type is limited in function and value compared to other wetland types.

3.4.18 Site 578 – Kimball Pond Road Bog, Dunbarton

Description

Kimball Pond Road Bog is a kettle depression in sandy glacial outwash associated with the large Kimball Pond Wildlife Management Area in Dunbarton. This site is unique in that it was not directly identified by the Site ID Model, but is directly adjacent to two other wetland areas that were. Based on review of aerials and field investigation, it was decided to focus the restoration plan in this area on the bog habitat and the adjacent upland area.

The kettle hole bog occurs in an iceblock depression (commonly called kettle holes) in sandy glacial outwash. As with other true bog systems, it is relatively small, lacks any inlet or outlet, and lies directly adjacent to other glacial features (in this case a glacial esker). The adjacent esker has been mined for sand and gravel by the Town of Dunbarton. This activity has created a level of disturbance adjacent to this unique habitat, and therefore creates an opportunity to restore the site once mining activity is complete.

The vegetation within the bog is a ringed zonation pattern, which is typical of this wetland type. The bog mat has a mixture of tall and short shrubs that are predominantly ericaceous. Leatherleaf (*Chamaedaphne calyculata*) is dominant. Other typical ericaceous shrubs include rhodora, sheep laurel (*Kalmia angustifolia*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda polifolia* var. *glaucophylla*), Labrador tea (*Ledum groenlandicum*), and low-growing large and small cranberry (*Vaccinium macrocarpon* and *V. oxycoccus*). Scattered, stunted coniferous trees, primarily tamarack *(Larix laricina*) and black spruce *(Picea mariana*) occur throughout. A mixture of specialized bog plants grow on the hummocky sphagnum surface, including carnivorous pitcher plants (*Sarracenia purpurea*) and sundews (*Drosera rotundifolia* and *D. intermedia*).

Impairments

- The sole impairment to this site is the encroaching gravel mining operation directly to the east of the bog. The mining could create erosion into the bog, could impact the hydrology of the bog, and could create a site for the establishment of invasive species.

3.4.19 Site 666 – Turkey River Floodplain, Concord

Description

This site is associated with the Turkey River floodplain, on the south side of Clinton Street in Concord. It is closely related to Sites 671 and 672, which are also associated with the Turkey River but which are located just north of this site. The Turkey River flows from the north to the south, bisecting the site, before it flows south to its confluence with the Merrimack River about two miles to the southeast.

The dominant characteristic of the site is its agricultural use. A band of floodplain forest is located along the Turkey River, which is dominated by red maple and other common floodplain forest species.

Impairments

- The majority of the site has been heavily impacted by agricultural use; hydrophytic vegetation has been replaced by cultivated species in most locations or by hydrophytic forage species (e.g., reed canary grass) in others.
- The hydrology of the northwest portion of the site has been modified by ditching and the practice of "plowing to the center," which has had the effect of raising the elevation of the farmland above the adjacent wetland.
- The presence of drain tile could not be confirmed, but is suspected in portions of the site.

3.4.20 Site 671 – Turkey River Floodplain, Concord

Description

This site is associated with the floodplain formed by the confluence of the Turkey River and a perennial tributary to the river, on the north side of Clinton Street in Concord. It is closely related to Sites 666 and 672, which are also associated with the Turkey River floodplain. The Turkey River itself flows from the north to the south, bisecting the site, before it flows south to its confluence with the Merrimack River about 2¼ miles to the southeast.

The dominant characteristic of the site is its agricultural use. A band of floodplain forest is located along the Turkey River, which is dominated by red maple and other common floodplain forest species, and a similar riparian forest is located along the perennial tributary located to the east of Site 671.

Impairments

- The majority of the site has been heavily impacted by agricultural use; hydrophytic vegetation has been replaced by cultivated species.

- The hydrology of the entire site has been modified by ditching and the practice of "plowing to the center," which has had the effect of raising the elevation of the farmland above the adjacent wetland.
- The presence of drain tile could not be confirmed, but is suspected in portions of the site.

3.4.21 Site 672 – White Farm, Concord

Description

This site, located on the state-owned "White Farm," is an agricultural area which drains to a perennial tributary to the Turkey River. It is closely related to Sites 666 and 671, which are also associated with the Turkey River floodplain.

Like the two other candidate restoration sites in the vicinity, the dominant characteristic of the site is its agricultural use. A portion of the site is used to raise corn, while other areas appear to be hayed periodically. The site is bisected by the recently completed construction of the Langley Parkway connection to Pleasant Street.

The adjacent emergent wetlands are dominated by invasive species such as Phragmites and reed canary grass, while alder thickets are also important in adjacent scrub areas.

Impairments

- The majority of the site has been heavily impacted by agricultural use; hydrophytic vegetation has been replaced by cultivated species.
- The hydrology of the entire site has been modified by ditching.
- The presence of drain tile could not be confirmed, but is suspected in portions of the site.
- The construction of the Langley Parkway eliminated a portion of the wetland area within the site.

3.4.20 Site 689 – Burnham Brook, Epsom

Description

Burnham Brook, an important perennial stream, flows about 3 ½ miles from its headwaters near Garvin Hill in Chichester to its confluence with the Suncook River at Site 689. The brook in this location flows through an active commercial farm which includes a livestock operation.

Riparian wetlands border the brook on both side, but are wider and more intact along the west side of the watercourse. The southern part of the site lies within the Suncook River floodplain, and includes a portion of floodplain forest.

Impairments

- A portion of the site is farmed wetland; although certain areas are now used to grow crops, they appear to continue to meet criteria for wetland hydrology. Other areas may be drained wetlands.
- Burnham Brook appears to have been channelized, and there is relatively little vegetated buffer between the Brook and the adjacent agricultural operation.
- Farm runoff discharges to Burnham Brook; impacts to water quality are likely.

3.4.23 Site 704 – Bowen Brook, Concord

Description

Bowen Brook occupies a portion of the low, flat, broad Merrimack River floodplain that extends from Northfield and Franklin in the north, to Concord in the south. This reach of the river has similarities to the Litchfield portion of the river, described above for Sites 134 and 273. Like Litchfield, agricultural use of the floodplain remains an important use along this reach of the Upper Merrimack River.

The Bowen Brook site is located within a conservation easement managed by the NH Society for the Protection of NH Forests and other non-profit agencies. The dominant characteristic of the site is the farmed wetland that forms its central portion. Like other farmed wetlands, the native hydrophytic vegetation has been replaced by cultivated species. Despite the continual use for farming, evidence of hydric soils and wetland hydrology remain in place.

Bowen Brook itself lies on the eastern side of the site, and has been channelized and deepened such that the brook does not appear to have access to its floodplain. Based on interpretation of aerial photography, as well as information gathered during field work, it is likely that the brook was relocated from its original location in the center of the farm field many years ago.

Impairments

- Farmed wetland; normal conditions have been replaced by cultivated species, with periodic plowing and fertilization, eliminating normal wetland function and value.
- Bowen Brook has been channelized, compromising its value as a perennial stream, and a direct tributary to the Merrimack River.
- A decent buffer to the Merrimack is lacking in a portion of the site.

3.4.24 Site 705 – State Prison Farm, Concord

Description

This potential restoration site is located directly east of the Bowen Brook site, on the Penacook side of the river. Like Site 704, its dominant characteristic is its use as an agricultural field. Some remnant emergent shallow marsh is located within the site. This area is dominated by cattail, reed canary grass and sedges (*Carex* spp.), but is substantially impacted by past and present land use.

Impairments

- Much of the site is farmed wetland; normal conditions have been replaced by cultivated species, with periodic plowing and fertilization, eliminating normal wetland function and value.
- The perennial stream that flows through the site has been channelized and deepened, compromising its value as a perennial stream, and eliminating a source of hydrology for adjacent wetlands.
- There is no effective buffer between the stream channel and the adjacent agricultural use.

3.4.25 Site 733 – Gulf Brook Headwaters, Pittsfield

Description

This site is associated with an ephemeral stream that is the headwaters of Gulf Brook, and important stream that flows south to join the Little Suncook River in Epsom. The adjacent land use is rural low density residential and agricultural uses. The upland area directly adjacent to the site is maintained hayfield, and reed canary grass is dominant in some areas, with other grasses also present. While this site does not display the same level of substantial impairment of other sites included in the field study set, it is a useful example of a common situation, whereby a simple and inexpensive buffer creation strategy would have wildlife and water quality benefits.

Impairments

- There is no true buffer to the drainage; could be improved to protect downstream water quality and enhance wildlife usage.

3.4.26 Site 769 – Hunting Swamp Headwaters, Loudon

Description

This site is associated with a large, regionally significant wetland known as "Hunting Swamp." The site is located at the upper end of the system, and is bordered by an existing commercial nursery operation to the west which has expended over the last decade. Undisturbed forested wetland adjacent to the potential restoration site is best characterized as a northern red maple swamp.

Impairments

- The western portion of the site, adjacent to the nursery operation, has been cleared of its forest cover.
- Stormwater runoff from the adjacent nursery apparently enters the wetland without treatment.
- While it could not be verified, portions of the site appear to have characteristics of drained wetland, and tile drains may be in place.

3.4.27 Site 800/804 – Farmed Wetlands, Canterbury

Description

Site 800/804 is located in the floodplain of the Merrimack River in Canterbury and is dominated by the Gold Star Sod Farm, and active agricultural operation. The majority of the site has been modified to accommodate the agricultural use, which has been in place for many years.

A significant oxbow feature is also present within the site. This oxbow community is dominated by red maple, with a component of silver maple. An adjacent floodplain forest is also located on the western side of the site. The interspersion of these communities, together with the open pond located within the oxbow, creates wildlife habitat despite the intensive land use.

Impairments

- Portions of the site are farmed wetlands; normal wetland function has been impacted by cultivation, tilling and fertilization.
- The perennial outlet of the oxbow pond has been channelized, limiting its value as stream habitat.
- While it could not be verified, drain tile is likely in place over at least a portion of the site.

3.4.28 Site 806 – Tannery Brook, Boscawen

Description

Similar to other agricultural sites in the Merrimack River Floodplain, this site is characterized by former wetland which has been converted to cropland use. Much of the site has been protected through the use of an easement that allows continued agricultural use, but limits development. Tannery Brook flows through the site from its headwaters in northern Boscawen.

Impairments

- There is no effective buffer between the agricultural use and the adjacent Merrimack River.
- Tannery Brook has been impacted by the agricultural use, and is also lacking an effective buffer.
- A railroad grade bisects the site.
- The emergent portion of the wetland in the northern portion of the site shows evidence of degradation in the form of invasive species and a shift in community type from obligate hydrophytes to drier species.
- Portions of wetlands closest to NH Route 3 may have been filled in the past.

3.4.29 Site 825 – Kelly Brook Tributary, Loudon

Description

Site 825 is in a rural area of Loudon on the Pittsfield border. The site is characterized by a red maple riparian wetland along a perennial tributary to Kelly Brook. A portion of the swamp and its adjacent upland has been cleared and converted to agricultural use. The existing community is dominated by scrub-shrub species such as silky dogwood and winterberry holly, with the herbaceous layer dominated by cattail, wool-grass and reed canary grass.

Impairments

- A substantial buffer to the wetland is lacking.
- Runoff from the adjacent agricultural use contributes nutrients to the watershed. A constructed wetland or buffer could capture excess nutrients prior to entering the wetland system.

3.4.30 Site 1010 – Lower Shield Pond, Derry

Description

Site 1010, Lower Shield Pond in Derry, was identified for this study by the NH Natural Heritage Bureau, part of the NH Department of Resources and Economic Development that is responsible for tracking rare species and important natural communities in the state. The site contains a poor level fen/bog system with its classic fen sequence of floating mat, open peat, low heath, tall heath, dwarf spruce and larch, and shrub swamp.[6]

The lag varies from 20 to over 200 feet wide, although the low and high heath zones are not always well developed. The dominant plant in the low heath was leather leaf, the same species that dominated the Kimball Pond Bog in Dunbarton. Previous Heritage Bureau biologists found the threatened species *Gaylussacia dumosa* (dwarf huckleberry) within this community. Dwarf black spruce and larch are scattered throughout this zone. The shrub swamp further back from the pond is dominated by mountain holly, winterberry holly, and high bush blueberry.

Monitoring records provided by the Natural Heritage Bureau indicates a concern that beaver activity downstream may alter water levels within the site. Some precautions have already been taken by installing a beaver dam culvert downstream by the NH Route 28 bypass bridge. It is uncertain how flooding would ultimately affect plants in the peat lag, but it probably would kill present vegetation in favor of more aggressive, flood tolerant species.

Impairments

- A high-tension electrical line crosses the wetland, and a wide utility right-of-way runs parallel to the pond system to the north and east. Equipment and OHRV use of the corridor has impacted flow into the site.
- There has been some encroachment on the site by a landowner located on the northern boundary of the site.
- Residential development encroaches on the south and east. However, a reasonable buffer remains on the northwest side of the system.

3.5 Cost Estimates

A conceptual restoration plan was developed for each of the 30 example sites discussed in Section 3.4 above, as presented in **Appendix B**. To provide additional information for each of the example sites, a conceptual cost estimate was developed. The cost estimates are based on two-dimensional plans, with no verified information

[6] The description of this site was excerpted from information provided by the NH Natural Heritage Bureau.

on grading, planting, or engineering issues. Therefore, these estimates should not be interpreted to be final construction cost estimates, since the final restoration plans may differ from the concept plans in ways that would have a significant impact on construction costs. The estimates will allow comparison of the likely costs of each of the sites relative to one another and will help as a general planning tool.

A template estimating tool was developed to develop the cost estimates. This template lists each of the main activities needed to complete a restoration project including land costs, construction expenses associated with grading, planting, etc., as well as typical costs for planning, engineering and permitting. Cost information was taken from several sources:

- The NH Department of Transportation maintains a set of standard specifications for construction projects, and compiles a database of costs related to each item in the specification. NHDOT Item Numbers are from the publication, NHDOT Standard Specifications - 2006 Edition. NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.

- RS Means is a private company that maintains and publishes cost estimating tools for the construction industry. "Means" Item Numbers and Costs are taken from their publication, Site Work & Landscape Cost Data, 27th Annual Edition, 2008.

- For some items, particularly those for which no related item was found in either the NHDOT or RS Means databases, recent contractor bids from similar projects was used.

Each line in the cost estimate template cites one of these sources. Quantity estimates from each restoration plan were input into the template, which was then used to calculate costs. A spreadsheet for each of the sites in included in **Appendix E**.

3.6 Functional Benefits

The overall goal of the ARM Fund is to replace wetland functions and values lost through legally permitted activities. Under the rules that guide the award of grants from the ARM Fund, the site selection committee shall select projects that "*provide the greatest potential to replace or protect specific wetland functions and values lost by the impacts in the HUC 8 watershed.*" [NH Admin Rule Env-Wt 807.17(d)]

NHDES maintains a database of information on the functions and values lost through each project that has contributed to the fund. This database can be used to describe lost function and value in each of the watersheds.

It is possible to use the WRAM to estimate the functional benefit of restoration sites. As discussed in Chapter 2, a key part of the model is the concept of the "Net Functional Benefit." This portion of model uses a GIS-based approach to the *Method*

for Comparative Evaluation of Nontidal Wetlands in NH to estimate the amount of function provided by the existing wetland as well as that same system if it were fully restored. This calculation is performed for each of five main functions:

- Ecological Integrity
- Significant Habitats
- Flood Control
- Groundwater
- Water Quality

By comparing the existing and restored values for each of these functions, it is possible to project the relative amount of wetland function that can be created by a restoration site. **Appendix F** provides these data for each of the 30 example sites discussed in this chapter.

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.

5
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6
Glossary

Adaptive Management An iterative approach to managing ecosystems, where the methods of achieving the desired objectives are unknown or uncertain. In the context of wetland restoration, a process for the interactive management of a project.

ARM Fund Aquatic Resource Mitigation Fund; established by NH RSA 482-A to collect and distribute funds for the purpose of the restoration, preservation or creation of wetlands to offset the impacts resulting from the permitting of wetland impacts elsewhere.

Aquifer An underground porous, water-bearing geological formation.

Base Flow Stream discharge derived from groundwater sources as differentiated from surface runoff.

Berm A narrow embankment along a slope often used as dike or dam.

Biological Control The use of a species to consume or otherwise control the population of a pest or invasive species. One example is the use of beetles of the genus *Gallerucella* to control purple loosestrife.

BMP Best Management Practice; Design, construction, and maintenance practices and criteria for stormwater facilities that minimize the impact of stormwater runoff rates and volumes, prevent erosion, and capture pollutants.

Channelization The process of straightening a stream or river by removing natural meanders. A channelized stream has

	steeper slopes and faster stream flow.
Confluence	The place at which two streams flow together to form one larger stream.
Ditch Plug	Filling a portion of the drainage ditch to natural ground level.
Drain Tile	Pipe made of perforated plastic, burned clay, concrete, or similar material, laid below the soil surface to a designed grade and depth, to collect and carry excess water from the soil. Also known as a Tile Drain, Farm Tile or Field Tile.
Ecological Restoration	The process of using ecological principles and experience to return a degraded ecological system to a more ecologically functional state. The goal of this process is to emulate the structure, function, diversity, and dynamics of a specified ecosystem.
Eutrophic	Eutrophic waters generally have high levels of nutrients such as nitrogen and phosphorus; such waters can be choked by abundant plant life, rapid algal growth, and a lack of dissolved oxygen.
FGDC	Federal Geographic Data Committee; a committee formed by federal agencies which promotes the coordinated development, use, sharing, and dissemination of geospatial data on a national basis.
Function (Wetland)	A term used to describe wetland processes. A function refers to what a wetland does; the processes it performs.
Geospatial	Having to do with entities or events that can be described in a geographic fashion; mapped information is geospatial data.
GIS	Geographic Information System; A computerized system of organizing and analyzing any map-related data or information.
Headwater	The source of a stream; the water upstream from a structure or point on a stream.
Hydric Soil	A soil that is water saturated through a significant part of the growing season, or flooded long enough to eliminate oxygen in the root zone.

Heuristic Model	A set of ordered steps for solving a problem whose general purpose is not to find the optimal solution, but an approximate solution where the time or resources to find a perfect solution are not practical.
HUC	Hydrologic Unit Code; Refers to a strictly hierarchical mapping of watershed units conducted by US Geological Survey.
In-lieu Fee	A payment made to the ARM Fund; In–lieu fee mitigation occurs in circumstances where a permittee provides funds to the ARM Fund instead of either completing project-specific mitigation.
Monotypic	In assessing ecological dominance, a community with only one type or species.
OHRV	Off-Highway Recreational Vehicle such as a four wheeler or dirt bike.
Organic Soil	Soil derived from once living plant material, such as peat or muck.
Orthophotograph	An aerial photograph geometrically corrected (orthorectified) such that the scale is uniform: the photo has the same lack of distortion as a map.
Remote Sensing	Any technique for analyzing landscape patterns and trends using low altitude aerial photography or satellite imagery. Any environmental measurement that is done at a distance.
Tributary	A stream that flows into a larger stream or body of water at a confluence.
Udorthent	The technical term applied to soils in areas of cut and fill; made land.
Watershed	The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point.
Wetland Creation	An activity that results in the formation of a new wetland in an upland area.
Wetland Enhancement	An activity that improves the habitats and functions of an existing wetland.

Wetland Restoration	An activity that re-establishes the habitats and functions of a former wetland.
WRAM	Wetland Restoration Assessment Model; the GIS-based model built to complete this project consisting of the Site ID Model and the Site Prioritization Model.

Appendix A

ARM Fund Documents

New Hampshire RSA 482-A:28

Aquatic Resource Compensatory Mitigation Fund

Section 482-A:29

482-A:28 Aquatic Resource Compensatory Mitigation. – In lieu of other forms of compensatory mitigation, the department may accept payment for an unavoidable loss of aquatic resource functions and values from a proposed activity which at a minimum:

I. Impacts less than one acre of wetlands and meets the criteria for a United States Army Corps of Engineers state programmatic general permit.

II. Exceeds one acre of impact for a public roadway or a public utility project and meets the criteria for a United States Army Corps of Engineers state programmatic general permit

Source. 2006, 313:1, eff. Aug. 18, 2006.

Section 482-A:29

482-A:29 Fund Established. –

I. There is hereby established the aquatic resource compensatory mitigation fund into which payments made under this subdivision shall be deposited. The fund shall be a separate, non-lapsing fund continually appropriated to the department to be used only as specified in this subdivision for costs related to wetlands creation or restoration, stream restoration, preservation of upland areas adjacent to wetlands, and the subsequent monitoring and maintenance of such areas.

II. The fund may not be used to pay state personnel costs except, upon approval of the fiscal committee, to support up to one full-time position for administration of the fund and related projects. Only money from the 5 percent administrative assessment collected under RSA 482-A:30, III shall be used for this purpose.

III. The state treasurer shall invest the fund as provided by law. Interest received on such investment shall be credited to the fund.

IV. The wetlands council, established by RSA 21-O:5-a, shall approve disbursements of the aquatic resource compensatory mitigation fund based on recommendations provided by the site selection committee established under RSA 482-A:32, and in accordance with rules adopted by the commissioner.

Source. 2006, 313:1, eff. Aug. 18, 2006.

Section 482-A:30

482-A:30 Payment for Freshwater and Tidal Wetlands Losses. – For freshwater and tidal wetlands losses, the in lieu payment shall be the sum of:

I. The cost that would have been incurred if a wetland of the same type was constructed at the ratios adopted by the department based on a price of $65,000 per acre of wetland created, to be adjusted at the

beginning of the calendar year according to the annual simple rate of interest on judgments established by RSA 336:1;

II. The area of wetlands, as used in the calculation performed under paragraph I, times the cost of land in the municipality where the impact is occurring as calculated by the total assessed land values in the municipality, as determined by the department of revenue administration, which are equalized, divided by the number of acres in the municipality to yield a per acre equalized land value; and

III. An administrative assessment which equals 5 percent of the sum of paragraphs I and II.

Source. 2006, 313:1, eff. Aug. 18, 2006.

Section 482-A:31

482-A:31 Rulemaking. – The commissioner shall adopt rules under RSA 541-A relative to:

I. Identification of appropriate situations under which in lieu payments may be made. The criteria in RSA 482-A:28 shall be the minimum requirements for projects eligible for in lieu payments.

II. The method of calculating the amount of in lieu payments under RSA 482-A:30 which shall approximate the total cost of wetlands construction or such other mitigation actions as would have been required by the department and incurred by the applicant in the absence of making such payments. An administrative assessment of 5 percent of the total cost shall be added as part of the calculation method.

III. Criteria to use in selecting projects that would compensate for the lost aquatic resource functions or values.

(a) Tidal aquatic resources shall be compensated by the selection of qualifying tidal projects.

(b) An emphasis shall be given to selecting from among the qualifying projects those that are nearer to the site of the lost aquatic resource.

(c) No project shall be funded with in lieu payments from losses that occurred outside the hydrologic unit code 8 watershed, as developed by the United States Geological Survey, in which the project is located.

(d) Such criteria shall be adopted in consultation with the site selection committee established under RSA 482-A:32.

Source. 2006, 313:1, eff. Aug. 18, 2006.

Section 482-A:32

482-A:32 Site Selection Committee Established. –

I. There is established a site selection committee for the purpose of identifying projects to be funded from the aquatic resource compensatory mitigation fund.

II. The committee shall consist of the following members:

(a) The commissioner of the department of environmental services, or designee.

(b) The executive director of the fish and game department, or designee.

(c) The director of the office of energy and planning, or designee.

(d) The commissioner of the department of resources and economic development, or designee.

(e) Four members of the public, appointed by the governor and council for a term of 3 years or until a successor is chosen. The members of the public shall be as follows:

(1) A member of a municipal conservation commission at the time of appointment, who shall be one of 3 nominees submitted by the New Hampshire Association of Conservation Commissions.

(2) A natural resource scientist, who shall be one of 3 nominees submitted by the New Hampshire Association of Natural Resource Scientists.

(3) A person with experience in environmental protection and resource management at the time of appointment, who shall be one of 3 nominees submitted by the Nature Conservancy.

(4) A person with experience in environmental protection and resource management at the time of appointment, who shall be one of 3 nominees submitted by the Society for the Protection of New Hampshire Forests.

III. The members of the committee shall elect a chairperson annually.

IV. Each public member of the committee shall receive $50 per meeting. The other members of the site selection committee shall receive no compensation other than their regular state salaries but shall receive mileage paid at the rate set for state employees.

Source. 2006, 313:1, eff. Aug. 18, 2006.

Section 482-A:33

482-A:33 Report. – The department shall submit an annual report by October 1 beginning with fiscal year 2006, to the fiscal committee, the chairperson of the house resources, recreation and development committee, and the chairperson of the senate environment and wildlife committee summarizing all receipts and disbursements of the aquatic resource compensatory mitigation fund, including a description of all projects undertaken. Each report shall be in such detail with sufficient information to be fully understood by the general court and the public. After submission to the general court, the report shall be available to the public.

Source. 2006, 313:1, eff. Aug. 18, 2006.

Memorandum of Understanding
Between
NH Department of Environmental Services
US Army Corps of Engineers, New England District

I. **Purpose**: The purpose of this Memorandum Of Understanding (MOU) is to establish the procedures and guidelines for coordinating compensatory mitigation requirements for permits issued by the U.S. Army Corps of Engineers, New England District (Corps) in the State of New Hampshire under Section 404 of the Clean Water Act (33 USC 1344) and Section 10 of the Rivers and Harbors Act (33 USC 403) with the New Hampshire Department of Environmental Services (DES). This MOU is intended to provide more effective mitigation for authorized impacts to aquatic resources in the service area consisting of the entire State of New Hampshire by allowing permit applicants to provide payment to the Aquatic Resource Mitigation (ARM) Fund as required compensatory mitigation in circumstances considered appropriate by the Corps, in consultation with Federal and State review agencies. This MOU is an agreement between the Corps and DES, and it is not intended, nor can it be relied upon, to create any rights or a cause of action for third parties against the United States or the State of New Hampshire. The payments into the ARM Fund are for projects that meet the criteria for a New Hampshire Programmatic General Permit (NH PGP) and will fill less than one acre of wetland or are public roadway or public utility projects that will impact up to three acres. The ARM Fund may also be used in the resolution of unauthorized activities or other cases as agreed upon by the DES and Corps.

II. **Authority**:

a. The Clean Water Act (33 USC 1344) provides that Section 404 is administered by the Secretary of the Army. The Secretary has delegated the authority to administer this permitting program to the Corps. The NH PGP issued by the Corps has been adopted to minimize duplication between New Hampshire's regulatory program governing work within coastal and inland waters and wetlands and the Corps' regulatory program under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, while maintaining the environmental protections guaranteed by those Acts. Subject to certain exclusions and conditions, the NH PGP eliminates the need for applying for separate approval from the Corps for most minor, non-controversial work in New Hampshire when that work is authorized by the New Hampshire Wetlands Bureau DES. Similarly, the Federal Guidance on the Use of In Lieu Fee Arrangements for Compensatory Mitigation under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act recognizes in-lieu fee arrangements and states in pertinent parts that the Corps "may find circumstances where such arrangements are appropriate so long as they meet the requirements that would otherwise apply to an off-site, prospective mitigation effort and provides adequate assurances of success and timely implementation."

b. DES has required compensatory mitigation to be provided for impacts to jurisdictional areas since 1990 and adopted specific rules in 2004 detailing mitigation thresholds and requirements. The New Hampshire legislature passed a law in 2006 establishing the ARM Fund. The statute now describes the operation of the program and the mechanism that allows DES to receive funds for wetland impacts and disburse deposits in a fashion to maximize environmental benefits from the pooled funds. Administrative rules were adopted

in June 2007 for the program to operate within the context of the regulatory statutory requirements. The use of the ARM Fund for compensatory mitigation may occur only after the relevant permitted activity has complied with DES and Corps regulations and policies regarding wetland avoidance and minimization of impacts to wetlands and surface waters.

III. New Hampshire Department of Environmental Services, Aquatic Resource Mitigation (ARM) Fund Program:

a. The ARM Fund was established by an act of the NH Legislature and signed into law in 2006 (RSA 482-A:28 through :33). The ARM Fund is a non-regulatory program with a statutory mandate to protect and improve water quality, flood prevention, fisheries, wildlife, and plant habitats, through the restoration, creation and preservation of aquatic resources. The primary function of the Fund is to restore and preserve as many aquatic resources, buffers, and other beneficial lands in their natural condition as possible with the funds available. The primary emphasis of the ARM Fund is on aquatic resource restoration and protection, to include buffers and the preservation of aquatic resources and their adjacent uplands. The use of this ARM Fund for compensatory mitigation shall occur only after the relevant permitted activity has complied with DES and Corps regulations and policies regarding avoidance and minimization of impacts. The in-lieu fee option for wetland mitigation is only allowed after permittee-responsible mitigation options are considered and are deemed infeasible or less environmentally beneficial in the effort to address the loss of the wetland functions and values. DES accepts the legal responsibility for ensuring the mitigation terms are fully satisfied when an ARM payment is received.

b. To offset impacts to aquatic resources that resulted in payments into the ARM Fund, the DES shall be responsible for implementation and disbursal of funds. Mitigation resources shall consist of funds paid as mitigation by permit applicants to compensate for losses to aquatic resources in connection with issuance or verification of DES or Corps permits, resolution of unauthorized activities, or other cases as agreed upon by the DES and Corps as specified in sections above. The accounts for the ARM Fund shall be organized according to the Hydrologic Unit Code (HUC) 8 watershed level. Said funds shall be delivered to the DES, to be held in the ARM Fund according to the appropriate HUC 8 watershed, and used solely to accomplish mitigation projects as described herein within the watershed that generated the funds. The DES hereby agrees to receive and expend said funds in the manner and with the limitations described herein.

c. ARM Fund applications may request funding approval for costs associated with construction and/or preservation of mitigation projects including, but not limited to:

- labor,
- land acquisition,
- appraisals,
- surveys,
- project design,
- project management,
- monitoring,
- stewardship,
- legal,

- closing,
- equipment, and
- materials necessary to accomplish mitigation and monitoring.

Primary considerations in all mitigation project proposals and approval decisions shall be the benefit to the aquatic resources of New Hampshire and the most cost effective approach to accomplishment of mitigation projects. All funds shall be solely for the accomplishment of compensatory mitigation as described herein, and no funds may be expended except as provided for in this MOU.

IV. Goals:

a. The primary function of the ARM Fund is to restore and preserve in their natural condition as many aquatic resources, buffers, and other beneficial lands in or to their natural condition as possible with the funds collected. With the added flexibility incorporated into the DES compensatory mitigation program, proper placement of mitigation projects can be made within the landscape context, which can start helping to address the ecological needs of the state's watersheds and take into consideration cumulative effects.

b. An applicant may only pay money into the mitigation fund in lieu of actual mitigation when it has been sufficiently demonstrated that no feasible local opportunities for in-kind mitigation are available and there is no other acceptable mitigation bank with in-kind wetland types available. DES will contact the local Conservation Commission to obtain their recommendation regarding mitigation options. The goal of this MOU is to provide an additional compensatory mitigation alternative for permit actions that are required to submit a compensatory mitigation proposal in accordance with the DES Administrative Rules, Chapter Env-Wt 100-800. The funds generated by this mitigation option will be deposited according to the Hydrologic Unit Code (HUC) 8 watershed level. A total of 16 accounts will be established within DES for mitigation deposits corresponding to each of the 16 HUC 8 watersheds in New Hampshire. See Appendix A for a map of the HUC 8 watersheds. (A hydrologic unit code is an eight-digit number, determined by the U.S. Geological Survey, that identifies each of the watersheds into which the country has been divided for the purpose of water-resources planning and data management. The code uniquely identifies each of the four levels of hydrologic classification within four two-digit fields: region, subregion, accounting unit, and cataloging unit.) Funds will be disbursed according to the HUC 8 watershed.

c. DES will use funds accepted from a number of permitted projects collectively so as to maximize the size and/or quality of mitigation sites available for restoration, preservation or creation. This is to attempt to provide favorable mitigation ratios for aquatic resource impacts and to provide greater assurance of permanent protection of high quality natural areas in a broader landscape context. DES will maintain a running total of impacted and mitigated aquatic resources, by type and watershed, for which the ARM Fund was used as the form of mitigation for those impacts.

d. The ARM Fund will be spent on projects that provide the greatest potential to replace or protect specific wetland functions and values lost by the impacts that generated the funds paid into the HUC 8 watershed accounts. Where Fund project applications are similar,

preference shall be given to projects that provide the longer term, more beneficial protection mechanism for the project area and its buffer. A review of the overall environmental significance the project provides will be taken into consideration as well as its proximity and connectivity to lands protected in perpetuity. Other characteristics that will be considered include:

- provides a connection between lands that are currently unconnected and which are protected in perpetuity;
- protects linkages or over-land connections among and between one or more aquatic resource areas;
- protects lands within a large unfragmented block of land, relative to the HUC 8 watershed; and
- is located within the same sub-watershed as the impact area(s).

In addition, the overall mitigation potential for the project will be considered and the cost-effectiveness of the project and partnership potential will be reviewed.

V. Program Operation:

a. The operation of the program is described in RSA 482:-A:-28 through :33 and the DES administrative rules, Env-Wt 100-800. DES will generally determine the amount of an ARM Fund payment required from permittees. The payment is calculated by summing the following items:

(1) The cost that would have been incurred if a wetland of the same type was constructed at the ratios listed in Table 800-1 (Appendix B) in the DES administrative rules Env-Wt 100-800, based on a price of $65,000 per acre of wetland created, adjusted according to the annual simple rate of interest on judgments established by RSA 336:1, II;
(2) The area of wetlands that would need to be constructed, at the ratios listed in Table 800-1, times the cost of land where the impact is occurring as calculated by the assessed land values derived from the NH department of revenue administration equalization survey which are divided by the number of acres in each municipality to yield a per acre equalized land value; and
(3) An administrative cost that equals 5% of the sum of (1) and (2), above.

The calculation can be accessed at the DES web site at www.des.state.nh.gov. Occasionally the Corps may deem it appropriate to require additional payment to adequately compensate for direct and indirect impacts of a project.

b. Payments will need to be paid in full within 120 days of the DES approval of the project or the application will be denied. Payment into the Fund must occur prior to permit issuance to ensure mitigation obligations are fulfilled prior to start of construction. DES will deposit the ARM Fund monies into the appropriate individual, interest bearing accounts to be established for each of the 16 HUC 8 watersheds. Once a deposit is received, the permit authorizing the work to be performed will be issued. A summary of the projects and deposits made into the ARM Fund will be updated upon receipt of a deposit and will be available on the DES mitigation web page for public review.

c. DES shall oversee an application process for use of funds collected. An announcement for proposals shall be broadly circulated to all Conservation Commissions in the particular watershed, as well as to state agencies, land conservation organizations, watershed groups, and private consultants. Potential applications need to be in the HUC 8 watershed in which the impacts occurred that generated the funds. Once applications are submitted, an initial evaluation of the applications will be carried out by DES to determine eligibility. The evaluation of the application must take into consideration the impacts to aquatic resources mitigated via the ARM Fund, site suitability, baseline condition of the sites, the maximum return on expended funds, benefits to rare and endangered natural resources, the location and status of other mitigation projects, and an acceptable plan and budget.

d. A project-specific narrative for the ARM Fund proposals should include, if applicable, a description of the proposed project and site-specific plan including the location, baseline conditions, what kind of compensation can be provided, a schedule for conducting the project, monitoring and maintenance provisions, provisions for protection in perpetuity with real estate arrangements, and performance standards for determining ecological success of mitigation sites. For projects receiving funds from the ARM Fund, long-term preservation will be required through conservation easements or transfer of ownership to the respective town, State, natural resource agency, or qualified land conservation organization. In addition, funds will be withheld for remedial measures until DES deems the wetland construction site successful as defined in the project proposal. A performance bond will be required to ensure the construction is completed as proposed until DES deems the wetland construction site successful. The ARM Fund application and forms will be obtained from the DES.

e. Pursuant to RSA 482-A:32, an ARM Fund Site Selection Committee (Committee) has been established for the purpose of identifying projects to be funded. The Committee consists of the following members: A single representative from the Department of Environmental Services, Fish and Game Department, the Office of Energy and Planning, and the Department of Resources and Economic Development will be appointed by the respective Commissioner or Director of each such department or office. Four members of the public, appointed by the Governor and Executive Council for a term of three years will also serve on the Committee. These members represent each of the following organizations: the New Hampshire Association of Conservation Commissions, the New Hampshire Association of Natural Resource Scientists, The Nature Conservancy, and the Society for the Protection of New Hampshire Forests.

f. The ARM Fund shall operate separately from DES and Corps regulatory actions except as specified in this MOU. The following process for disbursements of ARM funds will be followed:

   1. DES will issue a Request for Proposals (RFP) when the ARM Fund Site Selection Committee agrees a watershed fund has accumulated sufficiently or when no more than 2 years has passed from the date of the first deposit. The RFP shall allow a minimum of 30 business days for applications to be submitted.
   2. DES will notify the NH Wetland Council and the Corps about the RFP, provide an impact ledger for the watershed account that is ready for disbursal, and request to be on a future Wetlands Council agenda to discuss Committee recommendations.

3. DES will conduct a preliminary review of the proposals to determine completeness and suitability for funding. DES will provide a summary to the Committee and the Corps of the reasons for qualifying or disqualifying proposals. Proposals that do not qualify will receive a letter from DES.
4. If DES determines a site visit is necessary, the Committee and the Corps will be provided the date(s) for the visit(s) and opportunity to attend.
5. Committee members will review proposals prior to Committee meetings and develop preliminary scores for each project for discussion at the scoring meeting.
6. The Committee will convene to review, evaluate and rank projects to receive ARM funds.
7. Committee recommendations will be presented to the Corps for approval. The Corps will review all projects involving restoration, creation, and/or enhancement using the current Federal guidance.
8. Those projects approved by the Corps will then be presented by DES to the Council for disbursal of funds.
9. DES will submit pertinent information to the Governor and Executive Council for authorization to release funds.
10. DES will oversee the completion of the funded projects and timing of payments for work described in a contract between DES and the party awarded the funds.

g. For ARM projects involving construction, the recipient of the ARM Fund monies shall continue to be responsible for construction, monitoring, and remediation until the NHDES and Corps determine the project has been satisfactorily completed. This shall be documented by both agencies in writing to the recipient of ARM funds.

VI. **Use of ARM Fund as Compensatory Mitigation by Corps:** This MOU acknowledges that Corps permittees can propose to make payments into the ARM Fund as an alternative to permittee-responsible compensatory mitigation when the Corps determines, taking into account input from the Federal resource agencies, that it is more ecologically beneficial. The permittee is required to provide the ARM Fund payment within 120 days of the DES approval, when the payment is also required by the DES. In situations where the DES permit functions as the Corps PGP authorization, any ARM fee will be considered compensatory mitigation under the Corps program as well. In situations where there is a separate Corps authorization, the required payments will be included in a mitigation special condition of the authorization letter. When the Corps requires mitigation and the DES does not, and the applicant requests to use the ARM Fund, the Corps will review the proposal, in consultation with the other federal resource agencies. If it is determined that use of the ARM Fund is appropriate, the permittee is required to provide the ARM Fund payment within 30 days of Corps authorization and before construction begins or the authorization is void.

VII. **Financial Controls:** The DES shall hold any funds collected pursuant to this MOU in an interest-bearing account in an investment instrument or banking institution so as to earn interest while maximizing the safety and preservation of the funds in the account. The DES shall account for the funds held, in accordance with generally accepted accounting principles, and the account shall be subject to audit. Interest earned by the ARM Fund shall remain with the ARM Fund.

VIII. **Administrative Overhead and Interest:** The DES shall receive an overhead fee amounting to 5% of the funds when the funds are deposited. The fee will come from the ARM Fund and is deemed to represent and reimburse reasonable overhead and related administrative costs of administrating the fund to accomplish the mitigation projects.

IX. **Time Constraints:** All funds from the ARM Fund accounts shall be allocated to specific projects within two years of the date the funds are received with exception of the 5% for administrating the ARM Fund. If more than two years pass from the date of receipt of funds and the funds have not been allocated, or no proposals for the funds meet the eligibility criteria, the DES, with concurrence of the Corps, may extend the disbursal date for another two years. Funds that remain in an account after the ARM Fund applications have been selected for funding shall be carried over in that watershed account for the next application cycle.

X. **Good Faith:** The parties hereto agree that both shall exercise their rights and obligations in good faith as contained in this MOU.

XI. **Reports**: The goal of the ARM Fund, from the perspective of the Corps, is to play an important role in meeting the national goal of No Net Loss of aquatic functions and values. The Corps will review data provided by the ARM Fund to ensure aquatic resource impacts are matched with sufficient compensatory mitigation in the form of restoration and creation to meet national standards. DES will report to the Corps on a yearly basis with the location of impacts within a specific watershed, amount of impacts permitted within a specific watershed, Cowardin classification of the impacted areas, and information on the functions lost through the permitted impact. The ARM Fund will provide a calendar year annual report to the Corps and include information on the following:

1. The permitted aquatic resource impacts that provided payment into the ARM Fund to complete their mitigation requirements. The information will be reported according to HUC 8 watersheds and include:
   - permit number (DES and Corps permit authorization numbers);
   - date permit/authorization issued;
   - acreage by aquatic resource type(s), functions and values lost by the project;
   - location/town; and
   - date of payment amount deposited into the ARM Fund.

2. The description of projects receiving ARM funds with the following details:
   - a description of each project funded and information on the progress or completion of those projects;
   - acreage and type(s) of aquatic resources restored, created, or otherwise protected in each HUC 8 watershed;
   - the success of the project based on performance standards developed by DES for the specific project;
   - mitigation type(s);
   - location;
   - costs;
   - fee and/or easement holder;

- date acquired; and
- date construction completed (if applicable);
- status of monitoring;
- status of financial assurances.

The reports will be made available to the public through the issuance by the Corps of a Public Notice and posting on the Corps website (www.nae.usace.army.mil).

XII. **Amendment and Termination:** Either party may terminate this MOU by giving ninety (90) days written notice to the other party. Amendments require written approval by both the DES and the Corps. Prior to termination, DES shall provide an accounting of funds and shall complete payment on contracts for projects approved by the DES and any expenses incurred on behalf of the account. Upon termination, after payment of all outstanding obligations as provided in Section 8 above, the remaining funds shall be disbursed as determined by the DES.

This MOU is acknowledged this 14th day of March, 2008.

U.S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DISTRICT

Curtis L. Thalken
Colonel, Corps of Engineers
Commander, New England District

14 march 08
DATE

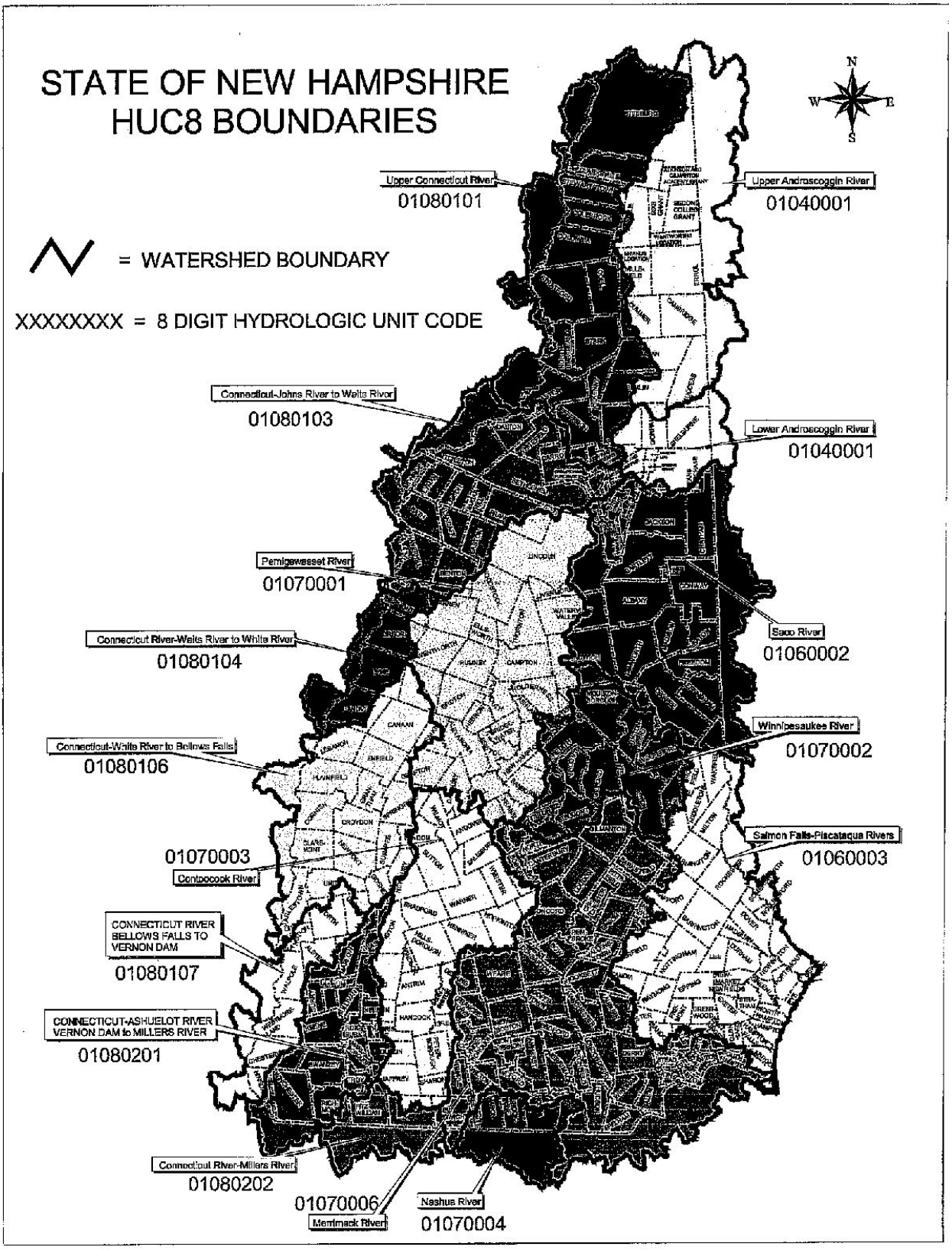
NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack
Commissioner, New Hampshire Department of Environmental Services

March 14, 2008
DATE

APPENDIX A

HUC 8 WATERSHEDS IN NEW HAMPSHIRE


STATE OF NEW HAMPSHIRE
HUC8 BOUNDARIES
N
W
E
S
= WATERSHED BOUNDARY
XXXXXXXX = 8 DIGIT HYDROLOGIC UNIT CODE
Upper Connecticut River
01080101
Upper Androscoggin River
01040001
Connecticut-Johns River to Wells River
01080103
Lower Androscoggin River
01040001
Pemigewasset River
01070001
Saco River
01060002
Connecticut River-Wells River to White River
01080104
Winnipesaukee River
01070002
Connecticut-White River to Bellows Falls
01080106
Salmon Falls-Piscataqua Rivers
01060003
01070003
Contoocook River
CONNECTICUT RIVER BELLOWS FALLS TO VERNON DAM
01080107
CONNECTICUT-ASHUELOT RIVER VERNON DAM to MILLERS RIVER
01080201
Connecticut River-Millers River
01080202
01070006
Merrimack River
Nashua River
01070004

APPENDIX B

TABLE 800-1
FROM CHAPTER Env-Wt 800 OF THE
NEW HAMPSHIRE CODE OF ADMINISTRATIVE RULES

TABLE 800-1 Minimum Compensatory Mitigation Ratios

Resource Type	Creation	Restoration	Preservation of Upland Buffer
Bog	N/A	2:1	15:1
Tidal Wetlands	3:1	2:1	15:1
Forested	1.5:1	1.5:1	10:1
Undeveloped Tidal Buffer Zone	N/A	2:1	3:1
All Other Jurisdictional Areas	1.5:1	1:1	10:1

Appendix B

Watershed Maps
(Under Separate Cover)

Appendix C

Functional Evaluation Detailed Methodology

Appendix C

C.1 New Hampshire Method: Functional Value 1 – Ecological Integrity

This Functional Value is designed to determine the sites carrying capacity or health associated with the ecosystem. It measures the sites ability to act as a natural buffer to human activity in the upland area surrounding the wetland. Sites with high ecological integrity scores are those that have remained relatively undisturbed from human activity and provide suitable habitat for plant and animal communities. In the NH Method, this Functional and Value is comprised of 12 parameters, not all of which could be answered using GIS. The scoring for this Function and Value follows the NH Method. Below is an overview of the parameters that were evaluated in this study.

C.1.1 Parameter 1 - Percent of candidate site having hydric soils and/or open water

Hydric soils remain wet throughout much of the growing season, and require more resources to develop. Due to this limitation, these wet areas tend to remain undisturbed from human activity. The higher the percentage of hydric soils, the more likely the site will remain undisturbed. A GIS overlay analysis was used to calculate the percentage of the restoration site consisting of hydric soils and/or open water. The percentages are then categorized into 3 groups; more than 50 percent, 25 to 50 percent, and less than 25 percent (Table C-1). The GIS operations associated with this parameter are summarized below.

1. **Intersect** (overlay) the candidates with the hydric soils layer
2. **Calculate** the acreage of the intersected areas
3. **Dissolve** the intersected areas for each candidate site, totaling the acreage.

C.1.2 Parameter 2 - Dominant land use within 500 feet of the candidate site

The land use adjacent to any wetland is a key indicator of any past development and can help determine whether or not any future development will occur. Restoration sites dominated by forested or agricultural land use patterns are likely to remain undisturbed, while sites with land use characterized as residential, commercial, and

other urbanized land uses patterns, show signs that the area will eventually lead to future development.

Table C-1. Ecological Integrity, Parameter 1

Model Variable	GID Data Source(s)	Ranking Attribute	Formula	Percent Hydric	Score
Site Area	Restoration Site	Area	Internal GIS Calculation	Hydric Area/Site Area	a. More than 50 percent = 1 b. From 25 to 50 percent = 0.5 c. Less than 25 percent = 0.1
Hydric Soil Area (including open water)	NRCS Soils	Area	Internal GIS Calculation		

The 2001 land cover data from the NH Land Cover Assessment study was the primary data source used in the analysis. Currently, this is the only statewide land cover/use dataset archived in NHGRANIT. A series of GIS overlay analyses were used to determine the dominant land use associated with the wetland. The land use was categorized into the following categories; agricultural, developed, disturbed, forested, and undeveloped. Sites dominated by agricultural or forested areas received the highest score (Table C-2). The GIS operations used in evaluation are summarized below.

1. **Buffer** the restoration site by 500'
2. **Erase** the internal area of the site from the buffer area so that only upland area exists
3. **Intersect** (overlay) the land use data with the upland buffer area
4. **Calculate** the area of each intersected area
5. **Dissolve** the intersected area for each restoration site, summarizing the intersected area by the land use attribute.
6. A series of **selections** were preformed on the attribute table from the result of step 5 to determine the dominant land use. See example below.
   a. Select all sites where Forested Acreage > Disturbed Acreage AND Forested Acreage > Developed Acreage, Score = 1

C.1.3 Parameter 3 - Water quality of the watercourse, pond, or lake associated with the wetland

The intent of this question is to identify sites associated with surface water with good water quality. Since poor water quality is believed to be detrimental to many species of animals and plant communities, sites located in these areas should be given a lower priority score. This question or parameter was evaluated using the NH DES Water Quality Assessment Program's Consolidated Assessment and Listing Methodology (CALM). The CALM is methodology for identifying and listing waters in NH as required by the Clean Water Act (CWA) of 1987.

Table C-2. Ecological Integrity, Parameter 2

GIS Data Source(s)	Model Variable	Source Attribute	Land Use Category	Score If Dominant Land Class
Restoration Site	Buffer Site by 500'	Buffer Overlay		
NH Land Cover Assessment	Land Use Area	110 Residential/Commercial/Industrial	Developed	0.1
		140 Transportation	Developed	0.1
		211 Row Crops	Agricultural	1
		212 Hay/Pasture	Agricultural	1
		221 Fruit Orchards	Agricultural	1
		412 Beech/Oak	Forested	1
		414 Paper Birch/Aspen	Forested	1
		419 Other Hardwood	Forested	1
		421 White/Red Pine	Forested	1
		422 Spruce/Fir	Forested	1
		423 Hemlock	Forested	1
		424 Pitch Pine	Forested	1
		430 Mixed Forest	Forested	1
		440 Alpine	Forested	1
		500 Water	***Open Water***	***1***
		610 Forested Wetland	Wetland	1
		620 Open Wetland	Wetland	1
		630 Tidal Wetland	Wetland	1
		710 Disturbed	Cleared/Disturbed	0.5
		720 Bedrock/Veg.	Undeveloped	1
		730 Sand Dunes	Undeveloped	1
		790 Other Cleared	Cleared/Disturbed	0.5
		800 Tundra	Undeveloped	1

In addition to the CALM database, NH DES maintains an existing GIS file of Assessment Units (AU) or surface water features (lakes, ponds, rivers) for the entire state that can be linked to the CALM database using a unique identifier. A few GIS preprocessing steps were used to link the CALM database to the GIS file for the AU's and create a new GIS representing only the AU classified as not meeting water quality standards (See Table C-3 for a listing of input datasets). For the purposes of this study, the TAG decided that all Assessment Units listed in the CALM under

NHDES Use Category 5-P, would be coded as not meeting water quality standards. A GIS "Select by Location" analysis was used to select out restoration sites that intersected an AU not meeting water quality standards.

Table C-3. Ecological Integrity, Parameter 3

Model Variable	Source Provider	Ranking Attribute	GIS Operation Used	Score
Site Boundary	Restoration Site	ID Number	Select all Sites that intersect an AU with NHDES Use Category of 5-P	a. Site associated with AU meeting water quality standards = 1
Assessment Units	NHDES	AU ID Number		b. Site associated with AU Not meeting water quality standards = 0.5

C.1.4 Parameter 4 - Population density (2000 Census) surrounding the site

To evaluate this parameter existing GIS sub-catchments were used from USGS Spatially Referenced Regressions on Watersheds (SPARROW) for NH. The Society for the Protection of NH Forests (SPNHF) recently updated the attributes of the SPARROW catchments for NH to include key data found in the 2000 Census, along with many other useful attributes. Sites were ranked using the following methodology:

1. **Intersect** Restoration Sites and SPARROW Sub-catchment units to determine if a restoration site falls within multiple catchment areas
2. **Calculate** the acreage of the intersected areas for each restoration site
3. For each restoration site, **calculate** the percentage of sub-catchment area located within it
    a. Percentage = Intersected Area/Site Total Area
4. **Calculate** the 2000 population density for each intersected area by multiplying the percentage from step 3, by each sub-catchment unit's 2000 population density. This required for only those sites located within multiple sub-catchments.
    a. [SPARROW_POPDEN2000] * [Percent_Site]
    b. At this stage, it is possible for a site to have multiple population densities.
5. Using the **Summary Statistics** tool, calculate a single population density for each site.
6. Populate the score by running multiple **selection by locations**

a. Example. Score = 1, if 2000 Population Density < 50 persons per square mile

Table C-4. Ecological Integrity, Parameter 4

Model Variable	Source Provider	Ranking Attribute	Score
Site Area	Restoration Site	Area	a. Density < 50 pp square mile = 1 b. Density between 50-100 pp square mile = 0.5 c. Density > 100 pp square mile
SPARROW Sub-Catchment Units	Society for the Protection of NH Forests	Population Density	

C.1.5 Parameter 5 - Percent of the original wetland filled

When a wetland is filled several if not all of the characteristics or functions of the wetland are lost. For example, filling a portion of a wetland might alter the hydrology of the entire wetland affecting the habitat it supports, flood storage protection, and loss of plant community. The key factor used to evaluate this parameter is the NH DES Wetlands Permit Database maintained by the Wetlands Bureau, which is available for the entire State as a GIS point file. In order to determine the percentage of the wetland system filled, each candidate site was buffered by 75 feet, and a GIS Spatial Join was used to select all sites where a wetlands permit had previously been issued. If a single wetlands permit has been issued previously, the site received a score of 0.5; if more than 1 permit was issued on the site, the site received a score of 0.1; otherwise the site was given a score of 1.0 (See Table C-5). An overview of the GIS operations used to evaluate this parameter are summarized below.

1. **Buffer** the restoration sites by 75'
2. Create a **spatial join** between the buffered sites and the NHDES Wetland Permits
    a. The spatial join create a field that counts the number of wetland permits located within each buffered area
3. Use the **summary statistics** tool on the joined layer summarizing the join count for each site
4. Populate the parameter score by executing multiple **select by attributes**
    a. Example. Select all sites whose join count is >1 and give it a score of 0.1

Table C-5. Ecological Integrity, Parameter 5

Model Variable	Source Provider	Ranking Attribute	Score
Site Area	Restoration Site	Proximity	a. No permits issues = 1 b. 1 permit issued = 0.5 c. More than 1 permit issued = 0.1
Wetland Permit	NHDES Wetlands Bureau	Proximity	

C.1.6 Parameter 6 - Percent of wetland edge bordered by a 500 foot buffer of woodland or idle land

Woodland and idle land buffers provide important habitat for many upland and wetland animal species. Buffers also act as a barrier to humans, which prevent noise and other human disturbances from entering the wetland. Parameter 6 was evaluated by looking at the percentage of forested or idle land within the 500' buffer zone surrounding each restoration site. For the purposes of satisfying this parameter, land use coded as wetlands in the 2001 NHLCA, were considered to be idle land. To calculate the percentages, the restoration sites were buffered by 500' and then intersected with the 2001 NHLCA. The result is a layer containing the geometric intersection of the two input datasets. A selection set was run on the intersected layer to identify the forested and idle land. Based on the selection set, a calculation was executed to total the amount of forest and idle land for each 500' buffer. The percentage was calculated by dividing the forest/idle land acreage, by the total acreage of the buffer area. The percentages were then categorized into 3 groups for the purposes of applying a score to each site.

1. **Buffer** restoration sites by 500'
2. **Intersect** the restoration site buffers with the 2001 NHLCA data
3. **Select** out the forested and idle land
4. **Calculate** the acreage of the forested and idle land on each site
5. **Dissolve** the intersected layer, totaling the amount of forested/idle land
6. **Calculate** the percent of forested/idle land by dividing the total acreage of forested/idle land by the total area of the 500' buffer.

Table C-6. Ecological Integrity, Parameter 6

Model Variable	Source Provider	GIS Operation	Score
500' Buffer Area	Restoration Site	Intersect	a. >80 percent forested/idle =1 b. 20 to 80 percent forested/idle = 0.5 c. <20 percent forested/idle = 0.1
Land Use	2001 NH land Cover Assessment	Select out forested and wetland land uses	

C.1.7 Parameter 9 - Percent of wetland plant community presently being altered by mowing, grazing, farming, or other activity

To satisfy this parameter, the Composite Wetland System (CWS) associated with the restoration site was evaluated. The CWS is created by merging the NRCS poorly drained and very poorly drained soils units with the National Wetlands Inventory (NWI) wetlands. In some instances the CWS is the entire restoration site, however, the majority of the restoration sites are a much smaller unit as illustrated in Figure C1. 2001 NHLCA data was used to identify agricultural areas within the CWS. The scoring for this parameter is based on the percentage of agricultural land in each CWS.

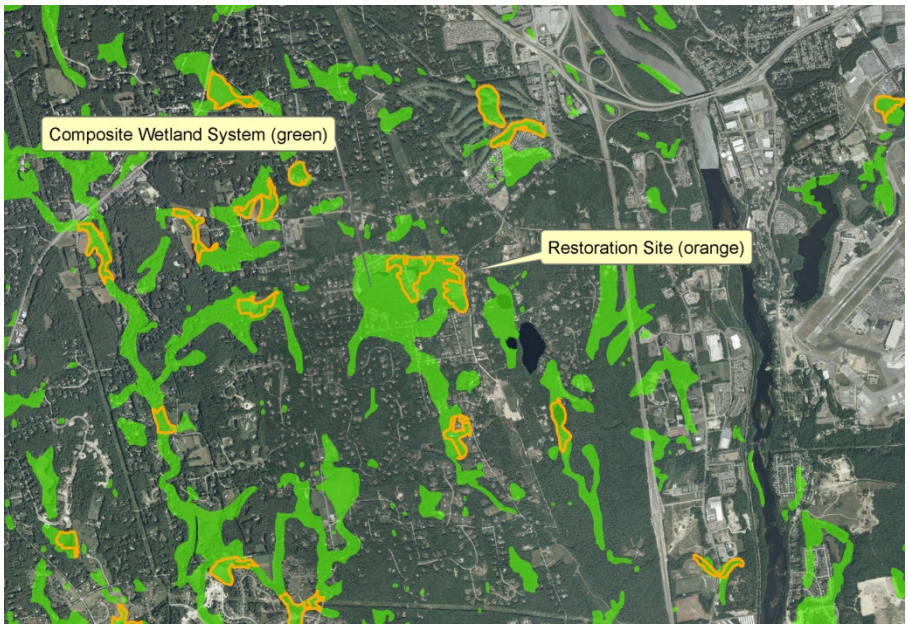


Figure C1. Ecological Integrity, Parameter 6

1. Create a temporary layer by selecting agricultural land uses from the 2001 NHLCA

   a. Agricultural areas = hay/pasture, orchards, and row crops

2. Intersect the temporary agricultural lands layer with the CWS layer

3. Use the intersected layer to calculate the acreage of agricultural land in each CWS

4. Calculate the percentage of agricultural land in each composite wetland system by dividing the acreage of agricultural land by the total area of the composite wetland system.

5. Join the CWS layer to the restoration sites and score the site accordingly

    a. The CWS layer contains a field summarizing the percentage of agricultural land in each CWS

Table C-7. Ecological Integrity, Parameter 9

Model Variable	Source Provider	GID Operation	Score
Restoration Site	Site Identification Model	Join Layer	a. < 10 percent = 1
Land Use	2001 NH Land Cover Assessment	Select out agricultural areas (hay/pasture, orchards, row crops)	b. 10 to 50 percent = 0.5
Composite Wetland System (CWS)	Site Identification Model	Intersect	c. > 50 percent = 0.1

C.1.8 Parameter 10 - Percent of wetland actively being drained for agricultural or other purposes

Within the NWI wetlands mapping data, a wetland code is available for each wetland. This code can be used to identify wetland systems that have a special modifier associated with them. The special modifier identifies if a wetland has been altered from its natural state. To access this information the last digit in the wetland code was evaluated. To satisfy this parameter any NWI wetland containing an "x" (wetland has been excavated), or a "d" (wetland has been partially drained/ditched) in the last digit of the wetland code was selected for analysis. The modified wetlands were then overlaid on top the CWS associated with each restoration site and a calculation was made to determine the percentage of modified wetlands in each CWS.

1. Using the NWI wetlands layer, **select** out wetlands with an 'x' or 'd' special modifier

    a. Example, NWI Code = PUBH**x** or NWI Code = PEM1E**d**

2. **Intersect** the wetlands with special modifiers from step 1 with the CWS layer

3. **Calculate** the acreage of modified wetlands in each CWS

4. **Calculate** the percentage of special modifiers in CWS by dividing the modified area by the total area of the CWS.

5. **Join** the CWS layer to the restoration sites layer and score accordingly

    a. The CWS layer contains a field summarizing the percentage of NWI special modifiers in each CWS

Table C-8. Ecological Integrity, Parameter 10

Model Variable	Source Provider	Ranking Attribute	Score
Restoration Site	Site Identification Model	Join Layer	a. < 10 percent = 1
NWI Special Modifiers 'x' & 'd'	National Wetlands Inventory (NWI)	NWICODE (last digit = 'x' or 'd')	b. 10 to 50 percent = 0.5
Composite Wetland System (CWS)	Site Identification Model	Intersect	c. > 50 percent = 0.1

C.1.9 Parameter 11 - Number of road and/or railroad crossing per 500 feet of wetland

Before calculating the number of crossings, the NH Method requires that the long axis of each restoration site be determined. To accomplish this, a preprocessing step is required using an ArcView 3.x GIS script. The script evaluates the polygon of each restoration site, and determines the longest axis (straight line). The output is GIS shapefile represented as a polyline for each restoration site that can be used to calculate the long axis length measured in feet. Once the long axis is determined for each site, a series of GIS procedures and calculations is performed on multiple data layers. A list of input layers and the scoring scheme can be found in Table C-9. Below is an overview of the GIS procedures used to evaluate this parameter:

1. **Intersect** streams, roads, railroads with the restoration sites

2. Use the **summary statistics** tool to summarize the road and railroad crossings for each restoration site

    a. The result is a table containing a count of the number crossings by restoration site

3. **Add a new field** to the long axis layer

    a. Field is used to store the crossing length

4. Use the attribute table **field calculator** to populate the field created in step 3

    a. Expression = Long Axis Length/500

    b. The result is used to calculate the number of crossing per 500' of wetland

5. **Merge** the resulting tables from step 2 into a single table
    a. The table contains a field with the total number of crossing
6. **Join** the table from step 5 to the long axis layer
7. **Calculate** the number of crossing per 500' using the expression below
    a. Crossing per 500' of wetland = Number of crossings/crossing length

Table C-10. Ecological Integrity, Parameter 11

Model Variable	Source Provider	Ranking Attribute	Scoring
Restoration Site	Site Identification Model	Intersect	a. 0 road crossing = 1
Long Axis	Preprocessing step using ArcView 3.3 Script	Long Axis Length	b. 1 or fewer road crossing = 0.5
Streams	USGS National Hydrography Dataset (NHD)	Intersect	c. More than 1 road crossing = 0.1
Roads	NH GRANIT	Intersect	
Railroads	NH GRANIT	Intersect	

C.1.10 Parameter 12 - Long-term stability of the site

To assess the long-term stability of each restoration site, special modifiers found in NWI mapping are combined with an active dam's layer provided by NHDES. Restoration sites associated with a wetland that has been identified as being diked/impounded 'h', excavated 'x', or impacted by beavers 'b', were selected out to be evaluated. In addition, all restoration sites located within 100' of an active dam were selected. Table C-11 provides a listing of the input data layers and the scoring scheme used in the evaluation. An overview of the GIS operations is listed below:

1. **Select** all NWI wetlands with the following special modifiers:
    i. 'h' diked/impounded
    ii. 'x' excavated
    iii. 'b' beaver
2. Execute a **select by location** on the NWI wetlands identified in step1 with the restoration sites layer
    a. If a restoration site touches the boundary of a 'h', 'x' or 'b' NWI wetland, set the score to 0.5
3. Execute a second **select by location** on the active dams layer with the restoration sites

a. Select all restoration sites that are within a distance of 100' of an active dam and set the score to 0.5

4. For all other restoration sites, set the score to 1

Table C-11. Ecological Integrity, Parameter 12

Model Variable	Source Provider	Raking Attribute	Scoring
Restoration Site	Site Identification Model	Proximity	a. Wetland appears to be naturally occurring, not impounded by a dam or dike = 1 b. Wetland appears to be somewhat dependent on artificial diking by a dam or dike = 0.5
NWI Wetlands with Special Modifiers 'h', 'x', or 'b'	National Wetlands Inventory (NWI)	NWI Code	
Active Dams	NHDES	Proximity	

C.1.11 Calculation of the Ecological Integrity Functional Value Index (FVI)

To calculate the FVI for Functional Value Ecological Integrity, the scores from the 10 parameters evaluated are summarized and averaged together to generate a single Ecological Integrity FVI score. The FVI score was then averaged with the remaining four functional evaluations to generate an overall FVI comprising 70% of the prioritization score.

C.2 Functional Evaluation for Significant Habitat

The NH Method uses two functional valuations to assess significant habitat; Wetland Wildlife Habitat, and Finfish Habitat. It should be noted that the NH Method does not evaluate habitat for any particular species, instead it associates a set of habitat characteristics for a broad range of species known to occupy wetland areas. The TAG reviewed each of the parameters associated with two functional evaluations and determined which ones could be assessed using GIS. In addition, the TAG identified two additional sources of information that should be included; Natural Heritage Bureau, plant species with low ranking exemplary natural communities, and habitat information from the 2006 Wildlife Action Plan (WAP). To be consistent with the NH Method the evaluation of significant habitat does not evaluate habitat for any particular species, instead it associates a set of habitat characteristics for a broad range of species known to occupy wetland areas.

C.2.1 Component 1 - NH Method Functional Value 2 – Wetland Wildlife Habitat

Of the 10 parameters associated with the NH Method FV2, 7 were evaluated in this study. The first parameter is the average FVI from Functional Value1 Ecological Integrity. An overview of the remaining steps and data layers used to complete evaluation is discussed below.

C.2.1.1 Parameter 2 - Area of permanent shallow open water (less than 6.6 feet deep) associated with the wetland

The NWI mapping data was used to select littoral wetlands and palustrine wetlands classified has having an unconsolidated bottom, aquatic bed, or unconsolidated shoreline, which are characteristic of wetlands with permanent shallow open water. With the shallow water systems identified, a GIS overlay analysis was used to determine if a restoration site contains any shallow open water and the amount. Table C-12, lists the critical data layers and the scoring used in this parameter. Below is summary of the GIS operations used to generate the scores:

1. From the NWI wetlands layer, **select** all sites associated with permanent shallow open water
    a. Littoral Lacustrine wetland systems
    b. Palustrine wetlands systems with an NWI code containing the following identifiers:
        i. UB – Unconsolidated Bottom
        ii. AB – Aquatic Bed
        iii. US – Unconsolidated Shoreline
2. **Intersect** the selected set of wetlands from step 1 with the restoration sites
3. **Calculate** the acreage of each intersected area
4. Use the **summary statistics** tool on the intersected layer from step 2 to summarize the total amount of permanent shallow water on each site
5. Complete the analysis by executing multiple **select by attributes** and field calculations to score each site
    a. Example. If the amount of shallow open water > 3 ac, score = 1

Table C-12. Significant Habitat, NH Method FV2 Parameter 2

Model Variable	Source Provider	Ranking Attribute	Scoring
Restoration Site	Site Identification Model	Area	a. More than 3 acres = 1
Permanent Shallow Open	National Wetlands	NWI Code	b. 0.5 to 3 acres = 0.5
Water	Inventory		c. Less than 0.5 acres = 0.1

C.2.1.2 Parameter 3 - Water quality associated with the watercourse, lake or pond associated with the wetland

See Ecological Integrity, Parameter 3.

C.2.1.3 Parameter 4 - Wetland diversity found on the site

Parameters 4, 5, and 6 from the NH Method were assessed primarily using the NWI wetlands mapping data and the acreage of each restoration site. For parameter 4; Wetland Diversity, the total number of wetlands classes (each of which should occupy > 20% of the total restoration site) were evaluated. A GIS overlay analysis is used to intersect the NWI wetlands with the restoration sites, and then a series of selections is completed on the intersected layer to determine how many wetland classes exist on each site.

1. **Intersect** NWI wetlands and restoration sites
2. **Calculate** the acreage of each intersected area
3. **Dissolve** the intersected layer for each restoration site and summarize the acreage from step 2
4. **Calculate** the wetland class ratio for each restoration site in a new field
    a. Ratio = wetland class acreage/restoration site acreage
5. **Select** out wetland classes that occupy more than 20% the restoration site
6. Use the **Summary Statistics** tool to generate a table listing number of wetland classes for a given restoration site
    a. The statistics tool creates a table with a frequency field. The frequency field contains the count of wetland classes for each restoration site.
7. **Join** table from step 6 to the restoration sites layer and score according to the NH Method

Table C-13. Significant Habitat, NH Method FV2 Parameter 4

Model Variable	Source Provider	Ranking Attribute	Score
Restoration Site	Site Identification Model	Area	a. Three or more wetland classes present = 1
Wetland Classes	USFWS National Wetlands Inventory	Area & NWI Code	b. Two wetland classes present = 0.5 c. One wetland class present = 0.1

C.2.1.4 Parameter 5 - Dominant wetland class found on the site

To determine the dominant wetland class, the resulting layer from the intersection of the NWI wetlands mapping and the restoration sites was used. The intersected areas were dissolved for each restoration site by wetland class, and the acreage was then calculated. The dominant class for each restoration site by finding the wetland class with largest acreage. The restoration site was then scored depending on the type of wetland class.

Not all restoration sites overlay with an NWI wetland because some restoration sites consist only of NRCS hydric soils and were not included in the NWI mapping. These restoration sites tend to be located in scrub/shrub forested areas. In addition, any restoration site whose dominant wetland class is less than 2 acres in size is coded as scrub/shrub forested. The reason for this is that a restoration site could be located in an area primarily of forested hydric soils, with only a small portion of NWI mapping. Without the 2 acre threshold the NWI wetland mapping would take precedence.

1. **Intersect** NWI wetlands and restoration sites
2. **Calculate** the acreage for each intersected area in a new field
    a. Dissolve the intersected layer, totaling the acreage field from step 2
3. **Dissolve** field = restoration site ID number, and NWI Code
4. Use the **Summary Statistics** tool to identify the largest NWI class based on acreage for a given site
    a. Output is a table containing a record for each restoration site
5. **Join** output table from step 4 to the dissolved layer created in step 3 to identify the dominant wetland class for each site
6. Score the sites according to the NH method

Table C-13. Significant Habitat, NH Method FV2 Parameter 5

Model Variable	Source Provider	Ranking Attribute	Score
Restoration Site	Site Identification Model	Area	a. Emergent Marsh and/or shallow open water = 1 b. Forested and/or scrub-shrub wetland = 0.5
Wetland Classes	USFWS National Wetlands Inventory	Area & NWI Code	c. Scrub-shrub saturated)bog) or wet meadow = 0.1

C.2.1.5 Parameter 6 - Interspersion of vegetation classes found on the site

In order to determine the amount of interspersion of vegetation classes for a given restoration site a ratio was used. The ratio is expressed as the number of NWI wetland classes located on each site, divided by the maximum number of NWI wetland classes found within the study set, which for this study equals 14. Below is an overview of the GIS procedures used to evaluate this parameter.

1. **Intersect** NWI wetlands and restoration sites
2. Use the **Frequency Statistics** to list all of the unique wetland classes that exist on each restoration site
    a. Output is table listing every wetland class located on a given site based on the NWI Code
3. Use the **Summary Statistics** tool on the resulting table from step 2 to summarize the total number of wetland classes on a given site
    a. The output is a table containing a single record for each restoration site
4. Run a second **Summary Statistics** analysis on the table from step 2, but choose the option to return the maximum value
    a. The output is a Table C-ontaining a single value equaling the maximum number of NWI wetland classes for the 951 restoration sites
5. **Join** the table from Step 4 to the output table in Step 3 to calculate the interspersion ratio
    a. Interspersion Ration = Step 3 output/Step 4 output

The scores for this parameter are continuous, 0 to 1.

C.2.1.6 Parameter 7 - Wetland Juxtaposition

In order to evaluate a sites juxtaposition in relation to other wetlands, a series of proximity analyses were used. Sites were scored based on their connectivity to other wetlands by a perennial stream or lake. Connectivity was evaluated using radiuses of 1 mile, 1 to 3 miles, and 3 miles. The steps below summarize the GIS procedures used in this evaluation.

1. **Select** all Sites within 1 mile of an NWI wetland
    a. Sites meeting this criteria are given an initial score of 0.1
2. **Select** all Sites within 50'of a stream and within 3 miles of an NWI wetland
    a. Sites meeting this criteria are given a score of 0.5
3. **Select** all sites within 50' of a stream and within 1 mile of an NWI wetland
    a. Sites meeting this criteria are given a score of 1.0

Parameter 10) Percent of the wetland edge bordered by upland wildlife habitat (brush, woodland, active farmland, or idle land)

This parameter is similar to FV1 Ecological Integrity parameter 6, where the ratio of wildlife habitat in the upland 500' is evaluated. The general steps outlined previously in FV1 parameter 6 are used to calculate the ratio, except active farmland (orchards, row crops, and hay/pasture) is considered wildlife habitat. The restoration sites are buffered by 500' and then a series of overlay analyses are used to calculate the percentage of wildlife habitat. The percentages were then classified into three categories for scoring.

1. **Buffer** restoration sites by 500 feet
2. **Intersect** 2001 land use data with the 500' buffer areas
3. **Select** out wildlife habitat from the intersected layer
    a. Wildlife habitat = forest land, hay/pasture land, row crops, orchards, tundra, sand dunes, and bedrock/vegetation land
4. Use the **field calculator** to calculate the acreage of the wildlife habitat
5. **Dissolve** the intersected layer, summarizing the total acreage of wildlife habitat on each site
6. **Calculate** the ratio of wildlife habitat on each site using the expression below
    a. Wildlife habitat ratio = acres of wildlife habitat/500' Buffer Area

7. Use the **select by attributes** function to score each site based on the wildlife habitat ratio

Table C-14. Significant Habitat, NH Method FV2 Parameter 10

Model Variable	Source Provider	Ranking Attribute	Score
Upland Area	500' Buffer of restoration sites	Area	a. More than 40 percent wildlife habitat = 1 b. 10 to 40 percent wildlife habitat = 0.5 c. Less than 10 percent wildlife habitat = 0.1
Land use	2001 NHLCA	Land use type	

C.2.2 Component 2 - NH Method FV 3 - Finfish Habitat

C.2.2.1 Parameter 1 - Amount of forested land in watershed above the restoration site

To evaluate this question, the upslope watershed for each restoration site is required. This was accomplished using ArcHydro software, which is a free extension for ArcGIS. A USGS Digital Elevation Model (DEM) is the primary data source used to generate the watersheds. Before the watersheds can be generated, several preprocessing steps are required for DEM. The steps for ArcHydro DEM conditioning include burning in a hydrologic network layer (streams), filling DEM sinks, calculating flow direction and flow accumulation in order to automate watershed delineation and are included in the ArcHydro online documentation. Once the DEM is processed the user can delineate upslope watersheds for the potential restoration sites automatically. Once the watersheds have been created, an overlay analysis is used to identify forested land within the watersheds.

1. Using the 2001 land use layer, **create a new selection set** by selecting out forested areas and wetlands
2. **Intersect** selection set from step 1 with the upslope watersheds
    a. The result is a polygon file representing upslope forested areas on a given restoration site
3. **Calculate** the forested acreage of each intersected area in a new field
4. **Dissolve** the intersected areas for each site, summarizing the acreage
5. **Join** the resulting layer from step 4 to the upslope watersheds layer
6. **Calculate** the ratio of forested area on each site by dividing forested acreage by the total area of the upslope watershed

7. Use the **select by attributes** function to score each site based on the ratio of forested area

Table C-15. Fin Fish Habitat, Parameter 1

Model Variable	Source Provider	Ranking Attribute	Scoring
Upslope Watershed	Created using ArcHydro Extension	Area	a. More than 80 percent forested = 1 b. 40 to 80 percent forested = 0.5
Forest Land	2001 NHLCA	Area	c.< 40 percent forested = 0.1

C.2.2.2 Parameter 2 - Water Quality of the watercourse associated with wetland

See FV1, Parameter 3

C.2.2.3 Parameter 3 - Barrier(s) to anadromous fish (such as dams, beaver dams, and road crossings) along the stream associated with the wetland

To determine if a barrier exists on a given restoration site, a series of proximity analyses were conducted. The creation of a culverts layer is needed to complete part of the evaluation. In order to create the culverts layer, several preprocessing steps are needed prior to running the model. The culvert layer is created by intersecting the NHD flowline (streams) layer with the most recent transportation network available in NHGRANIT. The result is a point file representing the intersected locations. The final preprocessing step is to eliminate any points that represent bridges. Using aerial photography and a bridge layer provided by the NH Department of Transportation (NHDOT) each point is reviewed to ensure that only culverts are represented in the dataset.

1. **Select** all restoration sites that are within 100' of a stream
2. **Select** all restoration sites that **intersect** with an NWI wetland with a special modifier of beaver or diked/impounded
3. Repeat step 1
4. **Select** all restoration sites that are located within 500' of a culvert
5. Repeat step 1
6. **Select** all restoration sites that are located within 500' of a dam
7. Any site selected in steps 2, 4, or 5 is given a score of 0.1

Table C-16. Fin Fish Habitat, Parameter 3

Model Variable	Source Provider	Ranking Attribute	Scoring
Restoration Site	Site Identification Model	Proximity	a. No barriers exist to fish passage = 1
Dams	NH DES	Proximity	
Culverts	National Hydrography Dataset and GRANIT Road Network	Proximity	b. Barriers exist preventing fish passage = 0.1
Wetlands with special modifiers 'b' or 'h'	National Wetlands Inventory (NWI)	Proximity	

C.2.2.4 Parameter 4 - Stream Bank Width

To evaluate the stream bank width associated on a given site, the Strahler stream order classification contained within the NHD flowline database is used. Sites associated with smaller streams received a lower score than sites associated with a large stream. To complete the analysis, the NHD flowline network was intersected with the restoration sites. If a site contained multiple streams with different stream orders, the larger one was selected.

1. **Buffer** NHD flowline by 100 feet
2. **Intersect** 100'buffer of NHD flowline with restoration sites
3. **Dissolve** the intersected area for each restoration site and summarize the data by selecting the highest stream order
   a. Case field = Identification number of the restoration site
   b. Statistics = Stream order (maximum value)
4. **Join** the dissolve layer to the restoration sites
5. Run multiple **select by attributes** to score each site based on the largest stream order
   a. Example. If stream order = 3 then site score = 0.5

Table C-17. Fin Fish Habitat, Parameter 4

Model Variable	Source Provider	Ranking Attribute	Scoring
Stream Order	NHD Flowline	Intersect	a. Stream Order >3, score = 1
Restoration Site	Site Identification Model	Intersect	b. Stream order = 3, score = 0.5 c. Stream order < 3, score = 0.1

C.2.3 Component 3 - Natural Heritage Bureau Exemplary Natural Plant Communities

The NH Natural Heritage Bureau provided a database in GIS format, of exemplary natural plant communities to include in the analysis of important habitat. A proximity analysis is used to select all sites that intersect such a plant community and are given a score of 1.0. All other sites receive a score of 0.5.

1. Use the **select by location** function to select all restoration sites that intersect an NHB exemplary natural plant community

2. All sites selected in step are given a score of 1.0, else other sites = 0.5

C.2.4 Component 4 - NH Fish and Game Wildlife Action Plan Data

C.2.4.1 Parameter 1 - Sites located in a high ranking habitat

The 2006 NH Fish and Game Wildlife Action Plan (WAP) identified 19 unique habitat types located in the State of New Hampshire. In addition to the habitat types, the plan identifies locations of high ranking habitat available in GIS format. The habitat was ranked into 4 categories; Tier 1, highest ranked habitat in ecological region, Tier 2 highest ranked habitat in biological region, Tier 3 supporting landscapes, and habitat not top ranked. To identify sites located within high ranking habitat areas, the composite wetland system (CWS) for each site is overlaid with the ranked habitat. Wetland systems located in multiple ranked habitats are classified with the higher of the highest tier. A preliminary score is applied to each site based on the composite wetland system the site is located within. A second overlay analysis is executed using the site boundary and the ranked habitat to code individual sites that are located within an area of ranked habitat.

1. **Intersect** Composite Wetland System (CWS) with Significant Habitat

2. **Add a new field** 'TierScore' to the intersected layer

    a. This field is used to identify the highest ranked habitat associated with each CWS

3. Using a series of **select by attributes**, populate the field 'TierScore' with the appropriate attributes

4. **Join** the intersected layer to a ID layer that contains the restoration site identification number and the CWS identification number

    a. A preprocessing step is used to create the layer with the identification numbers, which is then used an input to the model.

5. Using the **field calculator**, score the ID layer based on the 'TierScore' field found in the joined layer

    a. The scores reflect the highest ranked habitat in the CWS that a given site is located in

6. Using a series of **select by locations**, restoration sites located in high ranking habitat areas are selected and scored

    a. Example. Select all restoration sites located in Tier 1 habitat and give it a score of 1.0

    b. Example. Select all restoration sits located in Tier 2 habitat and give it a score of 0.5

Table C-18. Fin Fish Habitat, Ranked Habitat

Model Variable	Source Provider	Ranking Attribute	Scoring
Ranked Habitat	NH Fish & Game	Intersect	a. Tier 1 Habitat = 1
Restoration Site	Site Identification Model	Intersect	b. Tier 2 Habitat = 0.5
Composite Wetland system (CWS)	Site Identification Model	Intersect	c. Tier 3, or not top ranked = 0.1

C.2.4.2 Parameter 2 - Sites located within an unfragmented landscape

In the process of identifying important habitat areas, the NHFG created an unfragmented landscapes data layer. The layer was created using the 2001 NHCLA data in combination with the NH DOT roads layer. Areas of development and road surfaces were removed to create a contiguous area of land cover. For additional information, see the 2006 WAP documentation on unfragmented land. The restoration sites were intersected with the unfragmented landscape data layer, and the size of the unfragmented block was used as the ranking attribute. Sites located on a large (> 5,000 ac) unfragmented block are given a higher score than those located in a small (<1,000 ac) unfragmented block.

1. **Intersect** NHFG unfragmented blocks with restoration sites

2. **Dissolve** the intersected area for each restoration site and summarize the unfragmented block size

    a. The unfragmented block size exists as an attribute provided by NHFG

3. **Join** the dissolved layer to the restoration sites

4. Using a series of **select by attributes**, the score for each site was calculated

   a. Example. If unfragmented block size is between 1,000 and 5,000 ac, then the score = 0.5

Table C-19. Fin Fish Habitat, Unfragmented Landscapes

Model Variable	Source Provider	Ranking Attribute	Scoring
Unfragmented Landscapes	NH Fish & Game	Intersect	a. Block size >5,000 ac = 1.0 b. Block size 1,000 to 5,000 ac = 0.5 c. Block size <1,000 ac = 0.1
Restoration Site	Site Identification Model	Intersect	

C.2.5 Calculation of Significant Habitat Score

To calculate the FVI for Functional Value Significant Habitat, the parameters from the NH Method were average together and combined with the average scores from NHB and WAP evaluations. The FVI score will then be averaged with the remaining 3 functional evaluations to generate an overall FVI comprising 70% of the prioritization score.

C.3 NH Method: Functional Value 7 – Flood Control Potential

This Functional Value is designed to determine the potential for a given site to act as a natural flood control buffer. In the NH Method, the two main factors used to determine the flood control potential are storage (e.g. the amount of water that the wetland can hold) and the outlet flow rate. In addition to these two factors, the percentage of the site located within a FEMA floodplain, and the dominant wetland class was also evaluated.

In order to determine the values flood control potential of a given site two ratios need to be calculated; The storage ratio, expressed as the area of watershed for the potential site (WA) divided by the site area (SA) and the flow ratio expressed as the area of the watershed for the site divided by the wetland control length (WCL).

The flood control potential of restoration site was also evaluated based on its proximity to FEMA mapped flood zones and the dominant wetland class located within the floodplain. An overlay analysis was used to calculate the ratio of the FEMA mapped flood zone (FAREA) on each site. The ratio is expressed as the FAREA/SA using internal area calculations. The process was for determining the dominant wetland class was repeated from the steps outlined in FV2 Significant Habitat (parameter 5) outlined above.

In order to calculate the required ratios, a series of calculations and processing steps are performed in GIS to generate the numbers. The critical data sources are outlined below in Table C-20. Several preprocessing steps are needed to before calculation of the ratios. This includes the generation of upslope drainage areas for the potential restoration sites. For this model the ArcHydro extension was used to process a digital elevation model (DEM) of the MRW. The steps for ArcHydro DEM conditioning include burning in a hydrologic network layer (streams), filling DEM sinks, calculating flow direction and flow accumulation in order to automate watershed delineation and are included in the ArcHydro online documentation. Once the DEM is processed the user can delineate upslope watersheds for the potential restoration sites automatically. The WA/SA ratio is then calculated using the internal area calculations.

Table C-20. Flood Control Potential

Model Variable	GIS Data Sources(s)	Ranking Attribute	Formula and Ranking
Site Area (SA)	Restoration Site	Area	Internal GIS Calculation
Upslope Watershed Area (WA)	DEM Restoration Site	Area	Internal GIS Calculation
Wetland Control Length (WCL)	Bridge Dam Road Surface Waters	Proximity	Internal GIS Calculation
Flood Zone	FEMA/GRANIT	Area	Internal GIS Calculation

The WCL is estimated based on a series of proximity analyses based on the assumption that proximity to bridges, dams and roads will restrict the outlet flow potential at restoration sites as well as the proximity to New Hampshire surface waters. Based on the above proximity tests, the WCL length is then calculated as percentage of the perimeter of the restoration site. For sites with a large rating the WCL is equal to the perimeter of the site, medium rated sites the WCL is equal to 1/10th of the perimeter and sites rated low the WCL is equal to 1/100th of the perimeter. Table C-21 below summarizes the WCL ratings for restoration sites in the MRW.

Table C-21. Wetland Control Length Rating

Barrier Type	Outlet Type		
	No Outlet	NHD Water Body	NHD Flowline
No Barrier	Large	Medium	Medium
Dam	Large	Small	Small
Road	Medium	Small	Small
Bridge	Medium	Small	Small

Once the calculations for SA, WA and WCL are completed the flow and storage ratios can be calculated and used to determine the flood control potential score. The

table below provides a matrix for determining the appropriate score. When using matrix the Site Area and Watershed Area should be calculated in acres and the wetland control length should be calculated in feet.

Table C-22. Determining Flood Control Potential Score

Ratio B - Flow = Watershed Area / Wetland C. Length	Ratio A - Storage = Watershed Area / Site Area				
	Ratio A < 10 FVI	10<Ratio A<20 FVI	20<Ratio A<50 FVI	50<Ratio A<100 FVI	Ratio A> 100
0.1	0.0	0.0	0.0	0.0	0.0
0.2	0.1	0.0	0.0	0.0	0.0
0.4	0.3	0.0	0.0	0.0	0.0
0.8	0.5	0.3	0.0	0.0	0.0
1.0	0.6	0.3	0.0	0.0	0.0
2.0	0.8	0.5	0.1	0.0	0.0
4.0	1.0	0.7	0.3	0.1	0.0
8.0	1.0	0.9	0.5	0.2	0.0
16.0	1.0	1.0	0.7	0.3	0.1
32.0	1.0	1.0	0.9	0.6	0.2
64.0	1.0	1.0	1.0	0.8	0.4
128.0	1.0	1.0	1.0	0.9	0.7
256.0	1.0	1.0	1.0	1.0	1.0

To evaluate a sites flood control potential based on its proximity to FEMA mapped 100-year flood zone, an overlay analysis was used to calculate the ratio of the FEMA mapped flood zone (FAREA) on each site. The ratio is expressed as the FAREA/SA using internal area calculations. The steps for completing the overlay analysis are as follows:

1. **Intersect** the FEMA mapped 100-year flood zone with each site
2. Use the **Field Calculator** to calculate the FAREA on each site
3. **Join** the table from step 2 to the candidate sites layer and calculate the flood plain ration by dividing the floodplain area (FAREA)/Total area of the site
4. The scores are continuous, 0 - 1

Dominant Wetland Class

The process was for determining the dominant wetland class was repeated from the steps outlined in FV2 Significant Habitat (Parameter 5) outlined above. However, the scoring scheme has been modified:

- All sites dominated by a forested and littoral wetland system received a score of 1.0. Sites dominated by scrub/shrub wetlands were given a score of 0.5, and sites with emergent wetlands systems representing the dominant class received a score of 0.1.

C.4 New Hampshire Method: Functional Value 8– Ground Water Use Potential

This functional value is intended to evaluate the potential impact on ground water for each of the restoration sites. According to the New Hampshire method wetlands tend to have a purifying effect on water quality and the following method identifies those sites with most ground water use potential. The following parameters are evaluated in order to asses FVI 8; distance from existing public or private water supply wells, distance from potential public or private water supply and the ground water quality of the water supply. In addition to the NH Method, a sites proximity to a mapped NHDES potential contamination site (CSITE/CAREA) was evaluated.

Each parameter is evaluated using existing GIS data (Listed in Table C-23 below) to calculate values for FVI 8. Each distance parameter is evaluated as follows; sites with wells (public or private) or stratified drift aquifers less than <0.5 mile downstream are rated highest (1), sites with the features of interest between 0.5 and 1 mile downstream score in the mid range (0.5) and sites with no features within 1 mile downstream scored lowest (0.1). Since well locations are shown as points the total distance to wells was used as a surrogate to the downstream distance.

Table C-23. Ground Water Use Potential

Parameter	GIS Data Source(s)	Calculation
Site Location	Restoration Site	Location
Water Supply Existing	Well	Distance from site (Downstream)
Water Supply Potential	Groundwater Drift Aquifer	
Downstream Distance	New Hampshire Surface Water	Hydro Network And Routing
Potential Contamination	NHDES CSITE/CAREA Layer	Distance from Site

The ESRI Network Analyst extension is used to determine the downstream distance from each site to groundwater drift aquifers. The network analyst is used to create network from the New Hampshire hydrology layer. Point locations are added to the network that represented the restoration sites and the groundwater drift aquifers.

With the network layer and locations it is possible to calculate the downstream distance between the potential restoration sites and the aquifers. Table C-24 below summarizes the scoring procedure used to generate FVI 8 scores.

Table C-24. FVI 8 Score

Distance from well or stratified drift aquifer	FVI 8 Score	Water Quality of Stratified Drift Aquifer
Coincident	1	
< 0.5 Miles	1	Meets NHDES Standards
Between 0.5 and 1 mile	0.5	Requires Treatment
> 1 mile	0.1	Classified as unusable for drinking water
Neither upstream of or overlaying an aquifer	N/A	
Within 200' of a potential contamination site	0.5	
> than 200' of a potential contamination site	1.0	

The final step in calculating FVI 8 to include the water quality of the watercourse, pond or lake associated with the wetland. This score was calculated in FVI 1 and can be used again here. The five calculated scores are averaged to come up with a single FVI 7 value.

An example functional value 7 calculation is provided for site 8 above. Site x is located within 0.5 miles of a well (score 1), it is 1.5 miles upstream of a stratified drift aquifer (score 0.1), needs treatment (score 0.5) and has an FVI 1 V1.3 score of 0.2. The FVI 8 score for this site would be 0.45.

C.5 New Hampshire Method: Functional Value 9 & 10 – Sediment Trapping and Nutrient Attenuation

Sediment trapping and nutrient attenuation are measures of the potential for a site to capture and store pollutants from surface runoff in the upslope watershed. Each site is rated for the opportunity and potential for capturing the pollutants. The opportunity for capture is based on the average slope of the contributing watershed and the potential sources for sediment or nutrients. The potential for capture of sediment is based on the floodwater storage potential, the riparian buffer width of the site, the dominant wetland class, and the area of impounded open water on each site. The potential for nutrient attenuation is based on the potential for sediment trapping, dominant wetland class, and the Level 1 Assessment Unit (AU) score completed by NHDES.

Land use and soil erodibility of the upslope drainage area are used to calculate the sediment loading potential. The assumption is that certain combinations of land use soil erosion classes would provide different potential for sediment. The ESRI Spatial Analyst extension is used to convert the land use and soils data into two grids ranked according to Table C-25 below. The two grids are then multiplied together using the map algebra function to determine the sediment potential. Then the average sediment potential for each of the site's upslope drainage areas (generated during FVI 7 above) is calculated using the spatial statistics tool (Hawth's tools for overlapping polygons).

Table C-25. Sediment Potential for Upslope Drainage

Land Use	Factor (LU)	Highly Erodible Soils (HEL)	Sediment Potential
Water Forest Wetland	0	Not highly erodible = 0.2	Average of Erosion Risk = LI * HEL
Beech/Oak Forested Wetlands Other Hardwoods White/Red Pine Spruce/fir Hemlock Pitch Pine Mixed Forest Alpine Tidal Wetlands Sand Dune	0.1	Not Rated = 0.5 Potentially Highly erodible = 0.7 Highly Erodible = 1	Where For upslope drainage area
Orchards Tundra	0.2		
Non-Forested Wetlands Hay/Pasture	0.4		
Residential Commercial Industrial Transportation/Utilities Other Cleared Disturbed	0.8		
Row Crop	1.2		

Nutrient attenuation is calculated by generating a grid from the land use layer based on the values in Table C-26 below. The average Nutrient Attenuation score is then calculated for each watershed using the method described for sediment potential.

Table C-26. Nutrient Attenuation Potential for Upslope Drainage

Land Use	Factor (LU)	Nutrient Attenuation
Water	0	
Forested Wetland Beech/Oak Forested Wetlands Non-Forested Wetlands Other Hardwoods White/Red Pine Spruce/fir Hemlock Pitch Pine Mixed Forest Alpine Tidal Wetlands Tundra Sand Dunes	0.04	Average LU Factor for Contributing Watershed (LU x K ≥ 1 : 1)
Orchards Other Cleared Hay/Pasture Row Crop Disturbed Residential Commercial Industrial Transportation	0.42 1.5	

To calculate the riparian buffer width, the sites location to an intermittent or perennial lake or stream, two internal buffers (20′ and 50′) are applied to each restoration site. If the site provides a buffer of 50′ between stream/lake and upland, the site receives a score of 1.0. If the site provides a buffer of 20′ between stream/lake and upland, the site receives a score of 0.5. Otherwise the site receives a score of 0.1.

1. **Buffer** each restoration site by -50 feet and -20 feet creating two new files
   a. Internal-50
   b. Internal-20
2. Using the **select by location** function, each internal buffer is evaluated to see if it intersects with a stream
3. **Calculate** score for Internal buffers intersecting with a stream
   a. If Internal-50 layer intersects with a stream, then score = 1.0
   b. If Internal-20 layer intersects with a stream, then score = 0.5

4. Using the **select by location** function, select all restoration sites that are within 50 of a lake, pond, or river

    a. Sites meeting this criteria are given a score of 1.0

The dominant class associated with each restoration site was calculated in the Significant Habitat evaluation. However, the scoring for the dominant class is now based on wetlands ability to reduce storm flow, which in turn increases the amount of sediment trapping on the site. Sites dominated by scrub/shrub wetlands receive the highest score.

To determine the amount of impounded open water on each site, an overlay analysis using NWI wetlands and the restoration sites is required.

1. **Intersect** NWI wetlands and restoration sites
2. **Calculate** the intersected areas on each restoration site
3. Using the NWI code, **select** out areas of impounded open water

    a. Special modifiers 'b' and 'h'

    b. NWI codes with an 'OW' or 'L' classification

4. **Dissolve** the selected set of records from step 3 for each restoration site, summarizing the total acreage of open water.
5. Using a series of **select by attributes**, score each site based on the amount of open water

    a. Example. If Open Water Ac > 5, site score = 1

The FVI scores for sediment trapping and nutrient attenuation were averaged into a single water quality score, representing the fifth component of the Functional Evaluation. The 5 FVI scores were average together to generate a single functional evaluation score representing 70% of total score. This score will be combined with the sustainability and feasibility scores to generate total prioritization score for each wetland.

Appendix D

Model Output

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
1	5.7	1	123.2	2297.7	0.22	Merrimack River-Nashua River to Shawsheen River	2.4	3.2	2.4	2.4	4.5	0.0	6.9	Other
2	8.0	1	141.8	14.5	0.69	Merrimack River-Nashua River to Shawsheen River	3.2	3.6	1.5	1.5	5.4	0.0	6.8	Other
3	7.5	1	247.1	79.8	0.62	Merrimack River-Nashua River to Shawsheen River	2.7	3.3	2.7	2.7	5.7	0.0	8.4	Other
4	11.8	5	126.3	980.8	0.50	Merrimack River-Nashua River to Shawsheen River	3.0	3.3	2.5	2.5	4.6	5.0	12.1	Priority
5	101.6	14	134.9	676.3	0.79	Merrimack River-Nashua River to Shawsheen River	3.1	3.7	70.0	70.0	6.9	10.0	86.9	High Priority
6	24.1	5	123.8	1069.5	0.79	Merrimack River-Nashua River to Shawsheen River	2.6	3.4	12.8	12.8	6.6	5.0	24.4	High Priority
7	13.3	3	120.6	3490.7	0.36	Merrimack River-Nashua River to Shawsheen River	3.0	3.2	1.5	1.5	2.9	5.0	9.4	Other
8	21.8	2	145.3	122.9	0.63	Merrimack River-Nashua River to Shawsheen River	3.4	3.8	5.6	5.6	5.7	5.0	16.3	High Priority
9	15.5	5	189.8	195.1	0.52	Merrimack River-Nashua River to Shawsheen River	2.8	3.4	7.1	7.1	4.5	5.0	16.7	High Priority
10	7.6	2	132.8	75.0	0.66	Merrimack River-Nashua River to Shawsheen River	2.7	3.5	3.8	3.8	5.3	5.0	14.1	Priority
11	37.3	4	124.6	131.2	0.78	Merrimack River-Nashua River to Shawsheen River	3.7	4.1	10.4	10.4	6.0	5.0	21.4	High Priority
12	8.0	5	189.5	352.6	0.05	Merrimack River-Nashua River to Shawsheen River	2.5	3.2	3.9	3.9	1.4	5.0	10.3	Other
13	5.6	1	201.8	19.1	0.00	Merrimack River-Nashua River to Shawsheen River	2.6	3.5	2.8	2.8	1.5	0.0	4.3	Other
14	35.1	5	163.5	281.1	0.89	Merrimack River-Nashua River to Shawsheen River	2.7	3.4	17.1	17.1	8.3	5.0	30.4	High Priority
15	19.4	4	188.2	417.8	0.59	Merrimack River-Nashua River to Shawsheen River	2.4	3.1	8.9	8.9	5.0	5.0	18.9	High Priority
16	22.2	3	123.6	77.2	0.81	Merrimack River-Nashua River to Shawsheen River	3.6	4.0	5.8	5.8	6.1	5.0	16.9	High Priority
17	7.1	3	125.7	2833.0	0.00	Merrimack River-Nashua River to Shawsheen River	2.7	3.3	2.6	2.6	0.5	0.0	3.1	Other
18	5.0	3	948.2	317.6	0.74	Souhegan River	2.8	3.4	1.7	1.7	14.2	5.0	20.9	High Priority
19	6.1	3	116.6	690.6	0.43	Merrimack River-Nashua River to Shawsheen River	2.9	3.2	1.3	1.3	3.5	0.0	4.8	Other
20	7.2	1	123.7	31.3	0.61	Merrimack River-Nashua River to Shawsheen River	3.2	4.1	3.2	3.2	4.8	5.0	13.0	Priority
21	24.6	4	145.6	1610.1	0.00	Merrimack River-Nashua River to Shawsheen River	3.0	3.4	6.2	6.2	0.4	0.0	6.6	Other
22	11.2	1	180.3	790.3	0.96	Merrimack River-Nashua River to Shawsheen River	3.2	3.4	1.0	1.0	11.3	5.0	17.3	High Priority
23	13.9	3	326.7	111.8	1.00	Merrimack River-Nashua River to Shawsheen River	3.5	3.6	1.2	1.2	9.4	5.0	15.7	Priority
24	14.1	2	123.7	651.0	0.41	Merrimack River-Nashua River to Shawsheen River	2.4	3.0	5.3	5.3	3.3	5.0	13.7	Priority
25	8.0	2	150.0	2227.6	1.00	Merrimack River-Nashua River to Shawsheen River	3.0	3.3	1.5	1.5	9.5	5.0	16.0	Priority
26	5.7	2	134.7	925.2	0.56	Merrimack River-Nashua River to Shawsheen River	2.7	3.5	2.8	2.8	5.4	5.0	13.2	Priority
27	6.7	1	179.0	12.5	0.00	Merrimack River-Nashua River to Shawsheen River	3.0	3.6	2.2	2.2	1.5	0.0	3.6	Other
28	10.0	4	943.6	1068.1	0.90	Souhegan River	2.9	3.5	3.6	3.6	15.3	5.0	23.9	High Priority
29	5.8	1	143.7	261.8	0.49	Merrimack River-Nashua River to Shawsheen River	2.6	3.5	3.0	3.0	4.4	5.0	12.4	Priority
30	17.1	4	153.9	1173.3	0.38	Merrimack River-Nashua River to Shawsheen River	2.9	3.3	4.9	4.9	3.7	5.0	13.6	Priority
31	15.1	2	136.6	729.0	0.60	Merrimack River-Nashua River to Shawsheen River	3.1	3.5	3.6	3.6	5.3	0.0	9.0	Other
32	5.1	1	212.9	135.8	1.00	Merrimack River-Nashua River to Shawsheen River	2.6	3.1	1.7	1.7	8.6	5.0	15.3	Priority
33	5.1	2	154.8	2195.1	0.00	Merrimack River-Nashua River to Shawsheen River	2.4	3.2	2.4	2.4	0.4	0.0	2.8	Other
34	11.3	3	124.2	200.2	0.80	Merrimack River-Nashua River to Shawsheen River	2.2	2.9	5.2	5.2	6.8	5.0	17.0	High Priority
35	6.3	1	249.0	50.7	0.00	Merrimack River-Nashua River to Shawsheen River	2.4	3.2	2.6	2.6	1.5	0.0	4.1	Other
36	10.7	1	163.5	1054.6	0.62	Merrimack River-Nashua River to Shawsheen River	2.6	3.6	5.8	5.8	5.6	5.0	16.4	High Priority
37	6.2	1	235.5	32.3	0.00	Merrimack River-Nashua River to Shawsheen River	3.0	3.4	1.4	1.4	1.5	0.0	2.8	Other
38	30.3	6	153.5	407.7	0.89	Merrimack River-Nashua River to Shawsheen River	2.8	3.3	10.5	10.5	7.5	5.0	23.0	High Priority
39	27.2	1	145.6	533.6	0.89	Merrimack River-Nashua River to Shawsheen River	3.0	3.4	6.5	6.5	7.3	0.0	13.7	Priority
40	23.1	5	133.7	110.9	0.53	Merrimack River-Nashua River to Shawsheen River	3.9	4.2	4.0	4.0	4.5	5.0	13.5	Priority
41	5.6	1	140.0	35.8	0.05	Merrimack River-Nashua River to Shawsheen River	3.2	3.9	2.0	2.0	1.0	0.0	3.1	Other
42	21.3	4	210.9	731.7	0.92	Merrimack River-Nashua River to Shawsheen River	2.9	3.4	6.9	6.9	11.5	10.0	28.4	High Priority
43	14.4	6	932.8	644.5	0.73	Souhegan River	2.4	3.3	8.8	8.8	6.5	5.0	20.3	High Priority
44	7.0	2	154.8	130.8	1.00	Merrimack River-Nashua River to Shawsheen River	3.5	3.6	0.6	0.6	10.1	5.0	15.7	Priority
45	9.9	1	163.8	91.6	1.00	Merrimack River-Nashua River to Shawsheen River	3.5	4.0	2.5	2.5	11.2	5.0	18.7	High Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
46	6.2	1	168.5	6.9	1.00	Merrimack River-Nashua River to Shawsheen River	2.7	3.6	2.9	2.9	8.1	5.0	16.0	Priority
47	5.4	1	1078.1	3222.7	1.00	Souhegan River	3.1	3.4	0.8	0.8	17.9	5.0	23.8	High Priority
48	7.1	1	147.2	51.4	0.00	Merrimack River-Nashua River to Shawsheen River	2.6	3.4	3.2	3.2	1.5	0.0	4.7	Other
49	11.6	3	146.0	181.0	1.00	Merrimack River-Nashua River to Shawsheen River	3.3	3.7	3.3	3.3	9.4	5.0	17.7	High Priority
50	8.5	1	179.8	20.7	0.00	Merrimack River-Nashua River to Shawsheen River	2.3	3.1	3.9	3.9	1.0	0.0	4.8	Other
51	9.4	2	172.5	58.1	0.40	Merrimack River-Nashua River to Shawsheen River	2.9	3.6	3.9	3.9	3.8	0.0	7.7	Other
52	27.3	4	224.0	392.5	1.00	Merrimack River-Nashua River to Shawsheen River	3.0	3.2	3.6	3.6	16.2	10.0	29.7	High Priority
53	25.8	3	243.6	181.2	0.69	Merrimack River-Nashua River to Shawsheen River	2.8	3.5	12.5	12.5	5.2	0.0	17.6	High Priority
54	11.0	3	132.5	1450.5	0.85	Merrimack River-Nashua River to Shawsheen River	3.4	3.5	1.0	1.0	8.5	0.0	9.4	Other
55	5.3	1	140.5	1458.3	0.41	Merrimack River-Nashua River to Shawsheen River	3.0	3.5	1.4	1.4	5.5	0.0	6.9	Other
56	35.8	5	150.0	202.9	0.00	Merrimack River-Nashua River to Shawsheen River	3.0	3.4	11.5	11.5	0.9	5.0	17.4	High Priority
57	5.4	2	172.8	56.0	0.00	Merrimack River-Nashua River to Shawsheen River	2.6	3.4	2.4	2.4	0.2	0.0	2.6	Other
58	13.1	3	167.7	175.3	0.40	Merrimack River-Nashua River to Shawsheen River	2.5	3.1	4.9	4.9	4.8	5.0	14.7	Priority
59	6.7	2	273.0	31.8	0.30	Spickett River	2.6	3.4	3.0	3.0	3.4	0.0	6.5	Other
60	5.4	4	156.2	185.7	0.98	Merrimack River-Nashua River to Shawsheen River	2.7	3.5	2.8	2.8	7.6	5.0	15.4	Priority
61	9.5	2	417.2	115.7	0.72	Merrimack River-Nashua River to Shawsheen River	2.7	3.4	3.8	3.8	6.3	5.0	15.1	Priority
62	27.5	5	152.5	1278.7	0.83	Spickett River	3.3	3.5	2.8	2.8	8.0	0.0	10.8	Priority
63	7.1	2	304.3	68.0	0.15	Merrimack River-Nashua River to Shawsheen River	2.6	3.3	2.8	2.8	2.6	0.0	5.4	Other
64	5.4	1	152.7	231.3	1.00	Spickett River	2.2	3.0	2.3	2.3	11.8	5.0	19.1	High Priority
65	6.8	1	149.5	213.3	0.68	Merrimack River-Nashua River to Shawsheen River	3.2	3.6	1.6	1.6	6.0	0.0	7.6	Other
66	7.6	2	120.9	58.1	0.87	Spickett River	3.0	3.6	2.6	2.6	7.2	0.0	9.8	Other
67	50.5	5	176.0	1266.2	0.79	Merrimack River-Nashua River to Shawsheen River	2.7	3.3	23.2	23.2	6.6	5.0	34.8	High Priority
68	7.2	1	365.6	86.9	0.98	Merrimack River-Nashua River to Shawsheen River	2.9	3.5	2.5	2.5	11.5	5.0	19.0	High Priority
69	5.3	2	196.2	94.5	0.22	Spickett River	2.3	3.1	2.6	2.6	2.4	0.0	5.0	Other
70	13.9	1	119.3	4980.3	0.00	Merrimack River-Nashua River to Shawsheen River	2.9	3.3	3.0	3.0	2.4	5.0	10.5	Other
71	99.6	13	144.1	4593.9	0.44	Merrimack River-Nashua River to Shawsheen River	2.6	3.2	62.9	62.9	5.7	5.0	73.6	High Priority
72	6.3	2	135.5	21.0	0.76	Spickett River	2.6	3.1	2.1	2.1	6.5	5.0	13.5	Priority
73	6.2	3	118.3	29.8	0.00	Spickett River	3.3	3.6	0.9	0.9	1.0	0.0	1.9	Other
74	5.4	2	174.7	47.7	0.80	Spickett River	2.5	3.2	2.4	2.4	7.4	5.0	14.8	Priority
75	10.2	1	219.2	25.2	1.00	Spickett River	2.5	3.3	4.4	4.4	8.1	5.0	17.5	High Priority
76	31.3	2	117.0	260.1	0.10	Spickett River	2.4	3.2	14.1	14.1	3.7	10.0	27.8	High Priority
77	9.9	1	145.9	121.1	1.00	Merrimack River-Nashua River to Shawsheen River	3.1	3.7	3.2	3.2	8.1	0.0	11.4	Priority
78	10.2	1	115.4	158.0	0.17	Spickett River	3.0	3.4	2.4	2.4	2.3	0.0	4.7	Other
79	9.0	2	138.1	57.7	0.42	Merrimack River-Nashua River to Shawsheen River	3.3	3.9	3.1	3.1	3.7	0.0	6.8	Other
80	18.8	2	851.8	11847.9	0.54	Souhegan River	2.8	3.5	8.0	8.0	7.0	5.0	20.0	High Priority
81	37.9	3	129.1	197.8	0.97	Spickett River	2.8	3.5	16.8	16.8	9.6	5.0	31.4	High Priority
82	10.0	2	121.8	66.4	0.00	Spickett River	2.6	3.3	4.1	4.1	1.5	0.0	5.6	Other
83	8.4	1	130.3	42.9	0.72	Spickett River	2.8	3.4	2.6	2.6	7.2	5.0	14.8	Priority
84	6.9	2	154.0	6813.6	0.40	Merrimack River-Nashua River to Shawsheen River	3.1	3.5	1.8	1.8	6.2	10.0	18.0	High Priority
85	30.8	4	829.7	13228.3	0.20	Souhegan River	2.9	3.3	7.0	7.0	2.1	10.0	19.1	High Priority
86	5.4	1	124.3	40.3	0.00	Spickett River	2.6	3.4	2.4	2.4	1.5	0.0	3.9	Other
87	8.5	1	971.8	487.9	0.86	Souhegan River	3.3	3.5	0.8	0.8	14.5	5.0	20.3	High Priority
88	31.9	4	134.4	1993.8	0.20	Spickett River	2.8	3.4	11.6	11.6	3.5	5.0	20.1	High Priority
89	5.6	2	338.2	417.6	0.17	Litchfield-Hudson Tributaries	2.5	3.1	1.8	1.8	3.0	5.0	9.8	Other
90	7.6	1	376.0	32.0	0.78	Litchfield-Hudson Tributaries	2.7	3.5	3.2	3.2	6.7	5.0	14.8	Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
91	10.0	2	188.4	139.1	0.75	Merrimack River-Nashua River to Shawsheen River	2.6	3.3	4.0	4.0	7.0	5.0	16.0	Priority
92	6.7	2	1008.3	76.1	1.00	Souhegan River	2.8	3.4	2.1	2.1	8.8	0.0	10.9	Priority
93	6.8	2	172.1	307.6	0.20	Merrimack River-Nashua River to Shawsheen River	2.6	3.2	2.5	2.5	2.9	5.0	10.3	Other
94	5.2	2	128.8	29.8	0.56	Spickett River	2.8	3.5	2.2	2.2	8.8	5.0	15.9	Priority
95	7.0	1	116.1	263.4	0.42	Spickett River	2.6	3.1	1.9	1.9	6.5	5.0	13.4	Priority
96	12.3	3	115.3	236.1	0.00	Spickett River	2.9	3.5	4.8	4.8	0.7	0.0	5.5	Other
97	12.5	1	115.7	54.2	0.76	Litchfield-Hudson Tributaries	2.4	3.3	5.9	5.9	6.6	0.0	12.5	Priority
98	6.0	2	131.1	85.3	0.00	Spickett River	3.2	3.7	1.9	1.9	0.8	0.0	2.7	Other
99	7.0	2	230.0	202.3	0.93	Merrimack River-Nashua River to Shawsheen River	2.5	3.1	2.7	2.7	7.3	10.0	20.0	High Priority
100	9.4	1	129.2	36.4	0.55	Spickett River	2.6	3.4	4.1	4.1	5.2	5.0	14.3	Priority
101	7.2	1	191.7	7.6	1.00	Litchfield-Hudson Tributaries	2.4	3.4	3.9	3.9	7.3	0.0	11.2	Priority
102	10.4	5	169.3	90.4	0.53	Merrimack River-Nashua River to Shawsheen River	3.2	3.7	3.2	3.2	4.8	0.0	8.0	Other
103	5.3	1	200.6	8.7	1.00	Litchfield-Hudson Tributaries	2.9	3.6	1.9	1.9	8.1	5.0	15.0	Priority
104	9.8	2	1055.7	212.4	1.00	Souhegan River	2.5	3.2	3.6	3.6	10.9	0.0	14.5	Priority
105	5.3	1	136.2	24.7	0.22	Spickett River	2.6	3.4	2.2	2.2	3.3	5.0	10.4	Other
106	8.4	1	277.6	31.8	0.61	Merrimack River-Nashua River to Shawsheen River	2.6	3.3	3.5	3.5	6.7	5.0	15.3	Priority
107	6.0	2	238.5	174.1	0.99	Litchfield-Hudson Tributaries	2.6	3.1	1.8	1.8	9.3	5.0	16.1	High Priority
108	7.5	2	199.1	27.9	0.94	Litchfield-Hudson Tributaries	2.5	3.3	3.5	3.5	9.6	5.0	18.1	High Priority
109	6.9	2	187.8	802.0	0.81	Merrimack River-Nashua River to Shawsheen River	2.4	3.0	2.3	2.3	5.8	5.0	13.1	Priority
110	6.0	1	191.6	194.0	0.00	Litchfield-Hudson Tributaries	1.9	2.8	3.0	3.0	1.5	0.0	4.5	Other
111	5.8	3	176.6	5486.1	0.00	Merrimack River-Nashua River to Shawsheen River	2.9	3.5	2.2	2.2	1.3	0.0	3.5	Other
112	6.8	2	176.4	5379.1	0.92	Merrimack River-Nashua River to Shawsheen River	3.2	3.6	1.6	1.6	7.4	5.0	14.0	Priority
113	6.0	1	221.8	1391.2	0.02	Spickett River	2.6	3.2	1.8	1.8	1.6	0.0	3.5	Other
114	5.6	1	134.0	49.4	0.04	Spickett River	2.7	3.5	2.3	2.3	1.7	0.0	4.0	Other
115	5.3	1	222.1	19.8	0.59	Litchfield-Hudson Tributaries	2.8	3.6	2.4	2.4	10.9	5.0	18.3	High Priority
116	7.6	1	215.6	246.8	0.32	Litchfield-Hudson Tributaries	2.5	3.2	3.0	3.0	5.2	0.0	8.2	Other
117	5.5	1	124.4	10062.4	0.00	Spickett River	3.0	3.4	1.3	1.3	3.0	10.0	14.3	Priority
118	6.5	1	813.3	809.2	0.22	Souhegan River	2.4	2.9	1.9	1.9	4.0	5.0	10.9	Priority
119	8.8	1	196.1	87.8	0.69	Litchfield-Hudson Tributaries	3.6	4.0	1.9	1.9	5.2	5.0	12.1	Priority
120	18.2	2	253.9	262.4	0.62	Litchfield-Hudson Tributaries	2.4	3.0	7.1	7.1	5.6	5.0	17.7	High Priority
121	5.5	2	192.9	1300.1	0.90	Merrimack River-Nashua River to Shawsheen River	2.9	3.6	2.1	2.1	9.1	5.0	16.2	High Priority
122	5.7	2	193.1	27.2	0.78	Litchfield-Hudson Tributaries	3.6	4.0	1.3	1.3	7.7	5.0	14.0	Priority
123	7.1	2	192.5	9.9	0.01	Litchfield-Hudson Tributaries	3.3	3.7	1.7	1.7	8.7	5.0	15.4	Priority
124	11.2	1	186.7	34.4	0.61	Spickett River	2.4	3.2	4.8	4.8	5.5	10.0	20.3	High Priority
125	8.7	1	169.4	11.3	0.99	Litchfield-Hudson Tributaries	2.9	3.7	3.7	3.7	8.1	0.0	11.8	Priority
126	15.2	1	151.0	90.0	0.71	Spickett River	2.7	3.3	4.9	4.9	7.4	5.0	17.3	High Priority
127	5.1	2	201.6	5060.4	0.99	Litchfield-Hudson Tributaries	2.8	3.4	1.8	1.8	8.6	5.0	15.4	Priority
128	5.8	2	161.6	18.2	0.04	Spickett River	2.5	3.3	2.7	2.7	1.9	5.0	9.6	Other
129	5.3	3	231.3	583.0	0.25	Litchfield-Hudson Tributaries	2.4	3.3	3.1	3.1	2.9	0.0	6.1	Other
130	6.2	2	263.8	216.3	0.51	Merrimack River-Nashua River to Shawsheen River	2.5	3.1	2.5	2.5	4.9	10.0	17.4	High Priority
131	14.0	3	125.4	49.8	0.41	Spickett River	2.9	3.5	4.8	4.8	3.4	10.0	18.2	High Priority
132	9.0	1	212.8	87.0	0.66	Litchfield-Hudson Tributaries	2.8	3.6	3.7	3.7	6.4	0.0	10.1	Other
133	14.4	1	154.2	189.8	0.74	Litchfield-Hudson Tributaries	2.8	3.5	5.7	5.7	6.4	0.0	12.1	Priority
134	34.5	5	122.8	246.7	0.90	Litchfield-Hudson Tributaries	2.9	3.5	15.4	15.4	8.0	10.0	33.5	High Priority
135	7.3	1	236.5	140.7	0.72	Spickett River	3.0	3.4	1.7	1.7	7.6	5.0	14.3	Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
136	6.6	1	210.4	26913.3	0.12	Merrimack River-Nashua River to Shawsheen River	3.4	3.6	0.7	0.7	1.8	10.0	12.4	Priority
137	13.1	1	157.9	149.6	1.00	Litchfield-Hudson Tributaries	2.8	3.6	5.6	5.6	8.1	0.0	13.8	Priority
138	8.8	1	346.8	106.8	1.00	Souhegan River	3.0	3.6	2.9	2.9	8.1	0.0	11.0	Priority
139	5.8	1	164.0	11.3	0.00	Spickett River	2.4	3.2	2.5	2.5	1.0	0.0	3.5	Other
140	7.6	1	123.9	21.9	0.73	Spickett River	3.5	3.8	1.5	1.5	12.4	5.0	18.9	High Priority
141	9.1	1	195.5	1364.2	0.00	Litchfield-Hudson Tributaries	2.9	3.2	1.6	1.6	1.5	0.0	3.1	Other
142	6.7	2	219.9	13.2	0.82	Souhegan River	2.7	3.4	2.8	2.8	6.7	5.0	14.5	Priority
143	7.8	2	666.8	333.4	0.22	Souhegan River	2.4	3.2	3.9	3.9	2.0	0.0	5.9	Other
144	5.3	2	220.9	49.6	1.00	Spickett River	2.3	3.0	2.0	2.0	8.4	0.0	10.4	Other
145	6.4	2	217.9	80.9	0.98	Souhegan River	3.4	3.9	1.7	1.7	9.2	5.0	15.9	Priority
146	26.0	3	119.4	21118.7	0.77	Spickett River	3.3	3.5	3.0	3.0	6.4	5.0	14.4	Priority
147	20.0	1	835.7	32.1	0.25	Souhegan River	2.4	3.3	9.2	9.2	3.1	0.0	12.3	Priority
148	5.1	3	291.4	38.5	0.69	Litchfield-Hudson Tributaries	2.5	3.3	2.6	2.6	5.3	0.0	7.9	Other
149	10.6	1	206.6	90.4	1.00	Litchfield-Hudson Tributaries	2.9	3.5	3.4	3.4	8.1	0.0	11.6	Priority
150	6.3	1	219.1	12.5	0.95	Souhegan River	3.5	3.9	1.5	1.5	7.3	10.0	18.8	High Priority
151	7.8	2	216.8	14.8	0.50	Souhegan River	3.3	3.8	2.1	2.1	4.4	10.0	16.5	High Priority
152	5.9	2	452.4	427.1	0.31	Souhegan River	2.4	3.1	2.3	2.3	11.6	5.0	18.8	High Priority
153	7.6	1	198.5	145.5	0.48	Litchfield-Hudson Tributaries	2.6	3.4	3.3	3.3	3.7	5.0	12.1	Priority
154	7.5	1	753.3	7104.7	1.00	Souhegan River	2.5	3.0	2.2	2.2	17.5	5.0	24.7	High Priority
155	28.1	2	337.5	165.3	0.80	Merrimack River-Nashua River to Shawsheen River	2.6	3.2	10.7	10.7	6.9	0.0	17.6	High Priority
156	10.6	2	897.6	475.7	0.15	Souhegan River	2.3	3.1	4.7	4.7	3.1	5.0	12.7	Priority
157	7.5	1	160.8	241.9	0.00	Spickett River	3.6	3.7	0.7	0.7	0.7	0.0	1.4	Other
158	24.3	4	212.6	363.2	0.53	Souhegan River	3.4	3.8	5.9	5.9	4.5	5.0	15.4	Priority
159	6.7	1	189.4	26.7	0.02	Litchfield-Hudson Tributaries	2.9	3.5	2.3	2.3	5.2	5.0	12.6	Priority
160	7.0	1	724.6	7760.0	0.19	Souhegan River	2.4	3.1	2.7	2.7	2.7	0.0	5.4	Other
161	6.9	2	124.6	6169.8	0.04	Spickett River	3.2	3.6	1.6	1.6	1.7	0.0	3.3	Other
162	6.7	1	73.4	31.8	0.00	Merrimack River-Shawsheen River to mouth	2.9	3.7	3.3	3.3	0.3	0.0	3.5	Other
163	5.7	1	79.2	20.0	0.00	Merrimack River-Shawsheen River to mouth	2.8	3.6	2.6	2.6	1.5	0.0	4.1	Other
164	9.4	3	234.3	47.7	0.00	Merrimack River-Nashua River to Shawsheen River	2.9	3.6	4.5	4.5	0.7	0.0	5.2	Other
165	8.0	1	233.1	58.1	0.00	Merrimack River-Nashua River to Shawsheen River	2.7	3.6	3.9	3.9	0.7	0.0	4.6	Other
166	7.7	3	257.4	69.9	0.59	Litchfield-Hudson Tributaries	2.6	3.4	3.9	3.9	4.9	0.0	8.8	Other
167	24.2	2	176.2	106.1	0.95	Litchfield-Hudson Tributaries	2.8	3.5	9.4	9.4	6.8	0.0	16.2	High Priority
168	12.7	1	133.3	182.7	0.91	Litchfield-Hudson Tributaries	3.0	3.5	3.7	3.7	9.0	0.0	12.7	Priority
169	7.4	2	112.0	434.0	0.19	Merrimack River-Shawsheen River to mouth	2.7	3.2	2.6	2.6	2.8	0.0	5.4	Other
170	6.2	1	777.3	308.6	0.75	Souhegan River	2.4	3.1	2.2	2.2	6.5	0.0	8.7	Other
171	13.2	4	190.4	23.3	0.40	Litchfield-Hudson Tributaries	3.0	3.8	7.0	7.0	3.8	0.0	10.7	Other
172	13.9	2	258.4	409.6	0.32	Litchfield-Hudson Tributaries	2.8	3.4	5.3	5.3	3.1	5.0	13.4	Priority
173	6.8	2	126.7	6031.4	0.18	Spickett River	3.1	3.5	1.6	1.6	2.5	0.0	4.1	Other
174	6.2	3	142.3	140.7	0.18	Spickett River	2.9	3.5	2.5	2.5	2.4	0.0	4.9	Other
175	5.4	2	1137.1	128.0	0.89	Souhegan River	2.5	3.4	2.8	2.8	9.2	0.0	11.9	Priority
176	6.0	1	176.5	13.9	0.10	Litchfield-Hudson Tributaries	2.7	3.5	2.6	2.6	2.2	0.0	4.8	Other
177	6.2	2	216.9	413.0	0.49	Souhegan River	3.0	3.5	1.9	1.9	3.8	0.0	5.7	Other
178	16.7	3	216.3	8401.1	0.90	Souhegan River	3.0	3.5	5.0	5.0	6.4	10.0	21.4	High Priority
179	5.8	2	182.3	118.7	0.00	Spickett River	2.5	3.2	2.4	2.4	1.3	0.0	3.8	Other
180	8.9	2	214.1	2411.9	0.00	Merrimack River-Nashua River to Shawsheen River	2.8	3.5	3.6	3.6	6.0	5.0	14.6	Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
181	20.8	4	224.2	660.4	0.99	Souhegan River	3.2	3.7	7.2	7.2	9.6	5.0	21.7	High Priority
182	6.2	1	290.9	28.6	0.03	Merrimack River-Shawsheen River to mouth	2.6	3.5	2.9	2.9	0.7	0.0	3.6	Other
183	10.5	3	881.1	112.1	0.01	Souhegan River	2.4	3.3	5.5	5.5	1.0	0.0	6.5	Other
184	11.8	1	147.2	211.4	0.25	Spickett River	3.4	3.7	1.9	1.9	3.2	0.0	5.1	Other
185	10.4	3	674.8	678.5	0.23	Souhegan River	2.5	3.2	4.5	4.5	3.5	0.0	8.0	Other
186	5.2	1	161.9	796.1	0.96	Spickett River	3.0	3.6	1.9	1.9	9.8	5.0	16.7	High Priority
187	17.9	2	251.6	794.9	0.26	Spickett River	3.1	3.5	3.8	3.8	3.5	0.0	7.3	Other
188	5.2	1	871.2	43.1	0.19	Souhegan River	2.9	3.8	2.4	2.4	2.7	0.0	5.1	Other
189	7.6	2	62.2	8283.3	0.94	Merrimack River-Shawsheen River to mouth	3.0	3.6	2.7	2.7	7.6	10.0	20.4	High Priority
190	10.2	1	93.7	65.2	0.48	Merrimack River-Shawsheen River to mouth	2.5	3.3	4.4	4.4	5.0	5.0	14.4	Priority
191	20.6	5	173.8	724.8	0.86	Litchfield-Hudson Tributaries	3.5	3.9	5.5	5.5	7.1	5.0	17.7	High Priority
192	6.5	1	776.4	306.7	0.70	Souhegan River	2.5	3.1	2.2	2.2	8.1	0.0	10.2	Other
193	6.3	1	231.7	9.4	0.77	Souhegan River	3.6	3.8	0.9	0.9	6.6	0.0	7.5	Other
194	11.6	1	180.1	11900.1	0.00	Spickett River	3.1	3.3	1.5	1.5	0.4	5.0	6.8	Other
195	10.1	2	245.6	271.2	0.79	Souhegan River	3.2	3.7	2.7	2.7	6.3	5.0	14.0	Priority
196	9.5	1	335.5	59339.5	0.00	Souhegan River	2.6	3.2	3.1	3.1	0.2	5.0	8.3	Other
197	12.1	1	121.6	95.0	0.34	Litchfield-Hudson Tributaries	2.9	3.5	3.8	3.8	5.1	5.0	13.9	Priority
198	8.2	2	305.7	493.0	0.94	Litchfield-Hudson Tributaries	2.2	3.0	3.9	3.9	13.8	5.0	22.7	High Priority
199	6.0	3	254.8	1669.1	0.45	Merrimack River-Nashua River to Shawsheen River	2.4	3.2	3.0	3.0	3.8	5.0	11.8	Priority
200	20.0	2	246.8	2536.0	0.79	Souhegan River	2.8	3.5	8.9	8.9	7.6	5.0	21.6	High Priority
201	5.0	1	182.9	21.0	1.00	Spickett River	3.0	3.7	1.8	1.8	8.1	5.0	14.9	Priority
202	5.6	2	305.2	392.9	0.63	Souhegan River	2.3	3.0	2.3	2.3	6.1	5.0	13.4	Priority
203	5.1	1	77.8	8065.4	0.53	Merrimack River-Shawsheen River to mouth	2.9	3.4	1.4	1.4	5.0	5.0	11.4	Priority
204	5.6	1	220.0	659.5	1.00	Souhegan River	2.6	3.2	1.8	1.8	8.8	5.0	15.6	Priority
205	6.1	2	876.9	3139.2	1.00	Souhegan River	2.5	3.1	2.3	2.3	17.1	5.0	24.5	High Priority
206	5.4	1	247.6	236.2	0.03	Souhegan River	2.7	3.3	1.6	1.6	1.3	10.0	12.9	Priority
207	5.9	1	121.2	285.7	0.00	Merrimack River-Shawsheen River to mouth	2.5	3.2	2.2	2.2	1.3	0.0	3.5	Other
208	12.4	3	246.7	86.0	0.54	Souhegan River	3.0	3.8	5.9	5.9	5.5	5.0	16.5	High Priority
209	5.5	1	88.6	308.1	0.98	Merrimack River-Shawsheen River to mouth	2.8	3.3	1.5	1.5	8.7	5.0	15.2	Priority
210	5.2	2	164.9	244.9	1.00	Litchfield-Hudson Tributaries	2.5	3.4	2.5	2.5	9.7	5.0	17.2	High Priority
211	23.2	4	212.2	19499.1	0.79	Merrimack River-Nashua River to Shawsheen River	2.9	3.5	9.6	9.6	8.1	10.0	27.7	High Priority
212	12.6	4	177.7	377.3	1.00	Litchfield-Hudson Tributaries	2.7	3.4	6.1	6.1	9.1	5.0	20.2	High Priority
213	6.9	1	255.9	2922.2	0.19	Souhegan River	2.8	3.5	2.7	2.7	5.1	10.0	17.8	High Priority
214	5.9	1	296.0	14.1	0.00	Merrimack River-Nashua River to Shawsheen River	2.5	3.3	2.5	2.5	0.8	5.0	8.3	Other
215	6.1	2	236.8	35.0	0.92	Souhegan River	3.3	3.7	1.4	1.4	6.8	0.0	8.2	Other
216	6.8	1	189.2	11630.0	0.00	Spickett River	3.0	3.5	1.8	1.8	1.5	10.0	13.3	Priority
217	6.0	2	215.9	1845.1	0.23	Souhegan River	2.8	3.4	2.0	2.0	3.9	10.0	15.9	Priority
218	13.9	2	324.3	329.1	0.98	Litchfield-Hudson Tributaries	2.2	3.0	7.3	7.3	8.3	10.0	25.6	High Priority
219	8.1	2	331.4	168.4	0.95	Spickett River	2.5	3.1	3.1	3.1	8.7	0.0	11.8	Priority
220	6.8	5	123.4	875.2	0.21	Litchfield-Hudson Tributaries	2.4	3.0	3.0	3.0	2.7	5.0	10.7	Other
221	13.1	1	370.8	96.4	0.58	Litchfield-Hudson Tributaries	2.3	3.1	6.0	6.0	6.0	5.0	16.9	High Priority
222	8.2	2	227.7	17064.7	0.57	Merrimack River-Nashua River to Shawsheen River	2.9	3.6	3.3	3.3	4.4	5.0	12.8	Priority
223	8.7	1	810.6	4112.6	0.95	Souhegan River	3.3	3.5	0.8	0.8	10.6	0.0	11.4	Priority
224	6.5	2	258.8	8281.2	0.43	Souhegan River	2.5	3.4	3.5	3.5	11.2	10.0	24.7	High Priority
225	5.6	3	104.8	9.5	1.00	Merrimack River-Shawsheen River to mouth	2.6	3.3	2.6	2.6	9.4	5.0	17.0	High Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
226	6.6	2	97.3	5165.8	0.11	Merrimack River-Shawsheen River to mouth	3.0	3.3	1.1	1.1	2.2	0.0	3.3	Other
227	11.0	2	107.2	86.9	0.33	Merrimack River-Shawsheen River to mouth	2.9	3.7	5.5	5.5	3.8	0.0	9.2	Other
228	8.5	2	106.9	246.7	0.96	Litchfield-Hudson Tributaries	3.0	3.6	3.0	3.0	9.0	0.0	12.0	Priority
229	7.5	2	241.9	557.8	0.36	Souhegan River	3.0	3.4	1.8	1.8	4.6	10.0	16.4	High Priority
230	19.6	3	270.1	2707.3	0.63	Souhegan River	2.9	3.3	5.6	5.6	5.1	5.0	15.7	Priority
231	33.8	4	262.8	2606.1	0.78	Souhegan River	2.5	3.1	14.7	14.7	6.4	10.0	31.1	High Priority
232	17.7	2	898.5	2548.4	0.56	Souhegan River	2.4	3.1	8.0	8.0	5.3	0.0	13.3	Priority
233	19.2	6	233.5	380.7	0.00	Merrimack River-Nashua River to Shawsheen River	2.5	3.1	8.8	8.8	0.6	0.0	9.4	Other
234	9.1	2	223.8	6962.1	0.99	Souhegan River	2.9	3.6	3.7	3.7	7.4	5.0	16.1	High Priority
235	8.4	2	275.4	545.9	0.29	Souhegan River	2.8	3.2	2.2	2.2	3.0	5.0	10.2	Other
236	9.6	2	864.9	2769.6	0.49	Souhegan River	2.6	3.3	4.0	4.0	5.3	0.0	9.3	Other
237	5.5	1	877.0	126.6	0.21	Souhegan River	2.6	3.5	2.6	2.6	2.9	0.0	5.5	Other
238	30.1	2	130.7	356.3	0.82	Litchfield-Hudson Tributaries	2.8	3.5	12.0	12.0	9.2	0.0	21.2	High Priority
239	7.9	2	338.0	29.7	0.07	Merrimack River-Nashua River to Shawsheen River	2.8	3.3	2.5	2.5	0.9	5.0	8.4	Other
240	8.3	3	187.2	224.2	0.46	Souhegan River	3.1	3.7	3.2	3.2	4.6	5.0	12.8	Priority
241	12.4	4	329.8	1004.1	0.48	Merrimack River-Nashua River to Shawsheen River	2.6	3.2	5.4	5.4	4.0	5.0	14.4	Priority
242	13.3	1	109.6	403.1	1.00	Litchfield-Hudson Tributaries	3.1	3.7	4.1	4.1	8.1	5.0	17.3	High Priority
243	9.3	5	114.8	380.7	0.99	Merrimack River-Shawsheen River to mouth	2.6	3.3	4.4	4.4	7.8	0.0	12.2	Priority
244	6.7	3	105.9	2771.6	0.31	Merrimack River-Shawsheen River to mouth	2.8	3.2	1.7	1.7	4.3	0.0	6.0	Other
245	5.8	1	115.0	6.7	0.47	Litchfield-Hudson Tributaries	3.3	4.0	2.2	2.2	4.6	0.0	6.8	Other
246	17.8	1	228.2	6652.2	0.00	Souhegan River	3.2	3.6	4.0	4.0	5.5	10.0	19.4	High Priority
247	7.7	1	135.1	278.6	0.97	Merrimack River-Shawsheen River to mouth	2.1	3.0	4.1	4.1	8.0	5.0	17.0	High Priority
248	7.1	1	244.1	31.6	0.66	Merrimack River-Shawsheen River to mouth	2.9	3.6	2.6	2.6	5.9	5.0	13.5	Priority
249	7.9	1	179.6	26.0	1.00	Merrimack River-Shawsheen River to mouth	2.7	3.4	2.9	2.9	9.8	0.0	12.7	Priority
250	14.3	2	696.6	631.1	0.56	Souhegan River	3.0	3.2	1.7	1.7	12.8	5.0	19.5	High Priority
251	6.1	1	315.0	1694.5	0.23	Souhegan River	3.3	3.5	0.5	0.5	9.8	10.0	20.3	High Priority
252	7.5	1	368.1	53.3	0.66	Merrimack River-Nashua River to Shawsheen River	2.6	3.4	3.4	3.4	5.9	5.0	14.3	Priority
253	5.8	1	952.7	1650.0	0.07	Souhegan River	2.3	3.1	2.6	2.6	4.3	0.0	6.8	Other
254	5.3	1	255.4	15.5	0.78	Merrimack River-Nashua River to Shawsheen River	3.0	3.6	1.7	1.7	5.7	0.0	7.4	Other
255	7.6	2	224.4	1990.3	0.27	Spickett River	2.4	3.1	3.4	3.4	2.6	5.0	11.0	Priority
256	9.6	1	117.3	1745.5	0.98	Merrimack River-Shawsheen River to mouth	2.3	3.0	3.6	3.6	8.0	0.0	11.6	Priority
257	6.3	1	841.3	20.8	0.57	Souhegan River	2.3	3.1	2.9	2.9	5.3	0.0	8.2	Other
258	7.8	2	413.0	343.6	0.00	Merrimack River-Nashua River to Shawsheen River	2.1	3.0	4.1	4.1	0.4	0.0	4.5	Other
259	7.0	1	468.9	88.6	0.97	Souhegan River	2.8	3.4	2.4	2.4	8.6	5.0	16.0	Priority
260	5.6	1	123.6	16.8	0.31	Merrimack River-Shawsheen River to mouth	2.8	3.6	2.5	2.5	3.6	5.0	11.0	Priority
261	6.5	3	254.1	493.2	0.78	Spickett River	2.9	3.3	1.6	1.6	7.2	5.0	13.8	Priority
262	5.2	1	255.4	24.9	0.00	Spickett River	2.5	3.4	2.3	2.3	0.8	0.0	3.1	Other
263	10.9	6	208.1	639.4	0.51	Manchester Tributaries	2.3	3.0	5.8	5.8	4.8	5.0	15.6	Priority
264	5.9	1	225.3	541.5	0.01	Souhegan River	2.4	3.0	2.1	2.1	1.7	5.0	8.9	Other
265	7.3	1	261.1	66.9	0.00	Souhegan River	2.6	3.3	2.6	2.6	1.5	0.0	4.0	Other
266	11.0	1	96.8	52.3	0.17	Merrimack River-Shawsheen River to mouth	3.0	3.5	3.3	3.3	3.4	0.0	6.6	Other
267	14.7	1	241.5	298.9	0.86	Souhegan River	2.5	3.1	4.4	4.4	7.4	5.0	16.7	High Priority
268	5.2	1	371.2	52.8	0.59	Merrimack River-Nashua River to Shawsheen River	2.4	3.2	2.3	2.3	5.4	0.0	7.6	Other
269	5.1	1	123.3	682.1	1.00	Merrimack River-Shawsheen River to mouth	2.4	3.1	1.9	1.9	11.6	0.0	13.4	Priority
270	6.6	2	711.6	40.4	0.28	Souhegan River	2.6	3.3	2.8	2.8	4.7	5.0	12.5	Priority

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Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
271	16.0	1	119.1	607.0	1.00	Merrimack River-Shawsheen River to mouth	2.6	3.2	6.0	6.0	8.1	5.0	19.1	High Priority
272	5.3	1	801.9	125.4	1.00	Souhegan River	2.6	3.4	2.3	2.3	8.1	0.0	10.4	Other
273	45.9	1	125.0	446.2	0.51	Litchfield-Hudson Tributaries	2.9	3.6	18.0	18.0	6.1	10.0	34.1	High Priority
274	6.7	1	383.1	20.1	0.14	Merrimack River-Nashua River to Shawsheen River	2.6	3.3	2.8	2.8	2.4	0.0	5.3	Other
275	6.7	1	125.3	133.8	0.87	Merrimack River-Shawsheen River to mouth	2.7	3.4	2.7	2.7	7.3	5.0	14.9	Priority
276	5.7	1	133.7	596.1	1.00	Merrimack River-Shawsheen River to mouth	2.4	3.1	2.1	2.1	8.1	0.0	10.3	Other
277	7.0	3	220.9	75.2	1.00	Manchester Tributaries	2.7	3.5	3.1	3.1	9.0	5.0	17.1	High Priority
278	6.4	2	367.8	70.5	1.00	Manchester Tributaries	2.5	3.3	2.9	2.9	10.6	0.0	13.6	Priority
279	5.7	1	232.4	157.1	0.48	Merrimack River-Shawsheen River to mouth	2.5	3.2	2.1	2.1	4.7	5.0	11.8	Priority
280	6.2	4	289.0	692.0	0.57	Merrimack River-Nashua River to Shawsheen River	2.7	3.4	2.8	2.8	4.5	0.0	7.3	Other
281	5.7	1	291.6	12.5	0.07	Souhegan River	2.4	3.2	2.4	2.4	2.0	0.0	4.4	Other
282	5.5	2	422.1	477.4	0.51	Souhegan River	2.2	3.0	2.4	2.4	6.8	0.0	9.2	Other
283	5.9	1	339.8	15.4	0.17	Spickett River	2.6	3.4	2.7	2.7	2.6	0.0	5.3	Other
284	12.7	3	190.8	1426.3	0.06	Manchester Tributaries	2.7	3.2	4.2	4.2	1.5	0.0	5.7	Other
285	5.1	1	298.7	33.9	0.05	Spickett River	2.6	3.4	2.2	2.2	1.8	0.0	4.0	Other
286	7.6	3	132.5	29.7	0.19	Merrimack River-Shawsheen River to mouth	2.6	3.3	3.4	3.4	4.1	0.0	7.5	Other
287	13.6	1	459.2	33.0	0.98	Merrimack River-Nashua River to Shawsheen River	2.4	3.3	6.6	6.6	8.0	0.0	14.6	Priority
288	10.7	3	143.9	1744.7	0.84	Manchester Tributaries	2.6	3.1	3.8	3.8	8.3	5.0	17.1	High Priority
289	7.6	3	211.5	1161.6	1.00	Manchester Tributaries	3.0	3.2	1.2	1.2	8.7	5.0	14.9	Priority
290	5.6	1	328.7	93.8	0.19	Souhegan River	2.7	3.2	1.7	1.7	2.8	5.0	9.5	Other
291	7.1	2	258.4	4002.1	0.00	Merrimack River-Nashua River to Shawsheen River	2.7	3.2	2.3	2.3	0.7	5.0	8.0	Other
292	5.3	2	236.2	38.8	0.54	Merrimack River-Nashua River to Shawsheen River	3.2	3.9	2.3	2.3	4.1	0.0	6.4	Other
293	5.1	2	264.5	3784.7	0.00	Merrimack River-Nashua River to Shawsheen River	2.7	3.3	1.8	1.8	0.7	0.0	2.5	Other
294	10.7	3	697.3	40.4	0.48	Souhegan River	2.7	3.4	4.7	4.7	12.5	5.0	22.2	High Priority
295	67.4	5	235.9	10399.0	0.80	Merrimack River-Nashua River to Shawsheen River	2.5	3.4	40.4	40.4	5.9	0.0	46.3	High Priority
296	9.2	1	136.4	5928.3	0.98	Merrimack River-Shawsheen River to mouth	3.1	3.5	2.0	2.0	10.4	0.0	12.4	Priority
297	10.3	3	104.1	13.4	0.70	Merrimack River-Shawsheen River to mouth	2.7	3.4	5.0	5.0	6.7	0.0	11.7	Priority
298	5.7	2	723.9	27.9	0.15	Souhegan River	2.5	3.2	2.5	2.5	4.3	0.0	6.7	Other
299	20.1	2	242.7	586.6	0.89	Spickett River	2.7	3.4	8.2	8.2	8.1	5.0	21.3	High Priority
300	6.0	3	108.1	19.1	0.10	Merrimack River-Shawsheen River to mouth	2.8	3.5	2.6	2.6	2.4	0.0	5.0	Other
301	8.7	2	112.6	896.4	0.20	Merrimack River-Shawsheen River to mouth	2.4	3.0	3.4	3.4	3.0	0.0	6.4	Other
302	14.0	3	240.3	240.1	0.69	Merrimack River-Shawsheen River to mouth	2.8	3.4	5.3	5.3	9.3	5.0	19.6	High Priority
303	6.6	1	270.3	37.3	0.00	Spickett River	2.8	3.5	2.4	2.4	1.5	0.0	3.9	Other
304	8.9	1	771.5	30.2	0.00	Souhegan River	2.5	3.2	3.6	3.6	1.4	0.0	5.0	Other
305	9.9	2	182.1	431.9	0.18	Souhegan River	2.2	3.1	5.6	5.6	2.3	5.0	12.9	Priority
306	8.4	3	434.6	98.2	0.43	Merrimack River-Nashua River to Shawsheen River	2.5	3.2	4.0	4.0	4.7	5.0	13.6	Priority
307	6.4	2	174.6	5497.1	1.00	Merrimack River-Shawsheen River to mouth	2.4	3.2	3.0	3.0	12.7	5.0	20.8	High Priority
308	6.0	1	256.7	13.4	0.10	Spickett River	2.6	3.4	2.6	2.6	2.2	0.0	4.7	Other
309	14.2	1	693.1	2470.5	0.61	Souhegan River	3.1	3.3	1.2	1.2	13.3	5.0	19.6	High Priority
310	8.5	1	1235.4	142.0	0.93	Souhegan River	2.2	2.9	3.5	3.5	8.5	0.0	12.0	Priority
311	20.3	1	206.9	286.9	0.88	Merrimack River-Nashua River to Shawsheen River	2.9	3.6	8.3	8.3	8.1	5.0	21.4	High Priority
312	5.9	1	115.1	22.1	0.36	Spickett River	2.8	3.4	2.0	2.0	3.9	5.0	10.8	Priority
313	11.7	1	116.0	40.6	0.20	Spickett River	2.8	3.3	3.2	3.2	2.3	0.0	5.5	Other
314	22.2	2	981.5	34.3	0.97	Squannacook River	2.5	3.3	11.5	11.5	7.9	0.0	19.4	High Priority
315	10.3	3	1214.9	118.7	0.40	Souhegan River	2.6	3.3	4.9	4.9	4.0	0.0	8.9	Other

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
316	11.3	1	963.0	2067.8	0.00	Souhegan River	2.2	3.2	6.0	6.0	1.0	0.0	7.0	Other
317	5.1	1	973.9	1538.1	0.28	Souhegan River	2.5	3.3	2.5	2.5	2.8	5.0	10.2	Other
318	12.0	1	115.1	47.3	0.27	Spickett River	3.0	3.6	4.3	4.3	2.8	5.0	12.1	Priority
319	31.8	6	149.2	886.7	0.96	Merrimack River-Nashua River to Shawsheen River	2.9	3.4	12.0	12.0	10.8	0.0	22.8	High Priority
320	48.0	3	1070.6	1352.2	0.85	Souhegan River	3.3	3.6	8.0	8.0	15.3	5.0	28.3	High Priority
321	14.6	1	1088.2	855.5	0.44	Souhegan River	2.6	3.2	4.2	4.2	6.0	5.0	15.2	Priority
322	10.6	3	968.9	381.4	0.67	Souhegan River	3.0	3.2	1.4	1.4	11.8	5.0	18.3	High Priority
323	7.0	1	308.3	1420.3	0.72	Litchfield-Hudson Tributaries	2.6	3.1	2.1	2.1	6.7	5.0	13.8	Priority
324	15.3	3	125.0	260.6	0.00	Spickett River	2.6	3.5	8.4	8.4	5.3	5.0	18.7	High Priority
325	7.7	4	209.0	66.4	0.64	Litchfield-Hudson Tributaries	3.0	3.6	3.4	3.4	5.8	5.0	14.1	Priority
326	8.8	1	226.4	26.5	0.99	Litchfield-Hudson Tributaries	2.8	3.4	3.0	3.0	8.1	5.0	16.1	High Priority
327	5.1	1	187.9	13.1	0.69	Litchfield-Hudson Tributaries	2.8	3.6	2.3	2.3	6.1	5.0	13.4	Priority
328	6.7	1	204.1	113.0	0.63	Litchfield-Hudson Tributaries	3.0	3.5	1.5	1.5	6.2	5.0	12.7	Priority
329	6.2	1	913.2	1551.0	0.00	Souhegan River	2.3	3.0	2.4	2.4	1.5	0.0	3.9	Other
330	6.2	1	144.9	35.3	0.41	Spickett River	2.8	3.4	2.1	2.1	5.3	5.0	12.4	Priority
331	5.3	1	129.3	23.0	0.09	Merrimack River-Shawsheen River to mouth	3.1	3.7	1.9	1.9	2.1	0.0	4.0	Other
332	11.1	1	334.3	63.0	0.73	Merrimack River-Nashua River to Shawsheen River	2.5	3.3	5.1	5.1	6.4	0.0	11.4	Priority
333	20.8	1	268.1	3317.7	0.41	Souhegan River	3.3	3.6	2.5	2.5	3.5	5.0	10.9	Priority
334	8.4	2	212.8	336.0	0.37	Souhegan River	3.2	3.6	1.6	1.6	3.5	0.0	5.1	Other
335	10.9	2	209.8	279.3	0.39	Souhegan River	3.3	4.0	4.5	4.5	3.7	5.0	13.2	Priority
336	5.8	2	215.3	22.4	0.03	Souhegan River	3.5	4.0	1.8	1.8	7.4	5.0	14.2	Priority
337	5.1	1	272.6	53.9	0.00	Merrimack River-Nashua River to Shawsheen River	2.4	3.3	2.4	2.4	1.5	0.0	3.9	Other
338	13.1	1	269.2	5489.5	0.19	Souhegan River	2.7	3.5	5.7	5.7	2.0	5.0	12.7	Priority
339	5.4	2	212.0	436.5	0.32	Souhegan River	3.1	3.4	1.0	1.0	2.8	0.0	3.8	Other
340	13.4	4	130.6	236.6	1.00	Litchfield-Hudson Tributaries	2.7	3.4	6.1	6.1	9.3	5.0	20.5	High Priority
341	5.1	1	232.3	984.0	0.00	Merrimack River-Nashua River to Shawsheen River	3.2	3.7	1.4	1.4	1.5	0.0	2.8	Other
342	28.5	3	214.0	297.7	0.34	Souhegan River	3.1	3.9	13.0	13.0	3.2	5.0	21.1	High Priority
343	5.5	1	106.2	2437.0	0.00	Merrimack River-Shawsheen River to mouth	2.9	3.4	1.5	1.5	1.5	0.0	2.9	Other
344	6.6	1	139.4	3336.6	0.00	Merrimack River-Shawsheen River to mouth	2.5	3.1	2.2	2.2	0.8	0.0	3.0	Other
345	7.0	1	263.4	4116.1	1.00	Manchester Tributaries	3.2	3.3	0.7	0.7	8.7	0.0	9.4	Other
346	19.2	3	300.3	838.3	0.56	Merrimack River-Nashua River to Shawsheen River	2.6	3.3	8.5	8.5	4.8	0.0	13.3	Priority
347	9.2	4	327.1	36.2	0.38	Manchester Tributaries	2.4	3.2	4.8	4.8	3.7	5.0	13.4	Priority
348	32.5	4	119.5	73.1	0.46	Merrimack River-Shawsheen River to mouth	2.6	3.3	14.2	14.2	4.6	5.0	23.8	High Priority
349	7.4	1	266.3	4154.5	1.00	Manchester Tributaries	3.2	3.3	0.7	0.7	8.7	0.0	9.4	Other
350	24.8	2	66.1	1510.9	0.45	Merrimack River-Shawsheen River to mouth	2.6	3.2	8.7	8.7	4.1	0.0	12.8	Priority
351	5.4	2	207.8	70.8	0.00	Merrimack River-Shawsheen River to mouth	2.7	3.4	2.2	2.2	0.3	0.0	2.4	Other
352	14.2	1	425.7	215.8	0.99	Merrimack River-Nashua River to Shawsheen River	2.7	3.3	4.4	4.4	8.8	5.0	18.2	High Priority
353	5.5	1	298.7	3063.3	0.52	Merrimack River-Nashua River to Shawsheen River	2.2	3.1	2.8	2.8	4.9	5.0	12.8	Priority
354	7.1	1	80.5	89.9	0.00	Merrimack River-Shawsheen River to mouth	2.7	3.4	2.4	2.4	1.6	0.0	4.0	Other
355	6.5	1	247.7	134.0	0.37	Souhegan River	2.6	3.3	2.5	2.5	4.7	5.0	12.3	Priority
356	7.8	2	75.6	42.9	1.00	Merrimack River-Shawsheen River to mouth	2.9	3.5	3.0	3.0	13.7	5.0	21.7	High Priority
357	7.9	3	752.0	672.7	0.33	Souhegan River	2.3	2.9	2.9	2.9	4.9	0.0	7.8	Other
358	10.7	3	230.1	52.6	0.51	Souhegan River	3.1	3.9	5.2	5.2	4.4	5.0	14.6	Priority
359	7.5	3	311.0	297.2	0.01	Spickett River	2.3	2.9	3.1	3.1	2.4	0.0	5.5	Other
360	7.4	2	394.4	241.5	0.23	Merrimack River-Nashua River to Shawsheen River	2.7	3.3	2.7	2.7	2.8	0.0	5.4	Other

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
361	5.8	1	305.8	2868.0	0.22	Merrimack River-Nashua River to Shawsheen River	2.5	3.2	2.4	2.4	2.7	0.0	5.0	Other
362	9.7	3	239.9	89.3	0.62	Souhegan River	3.3	3.8	3.1	3.1	5.2	0.0	8.2	Other
363	7.1	2	219.4	14488.3	0.74	Souhegan River	3.2	3.4	0.7	0.7	6.0	0.0	6.6	Other
364	5.4	2	309.7	97.5	0.39	Merrimack River-Nashua River to Shawsheen River	2.4	3.2	2.7	2.7	4.9	0.0	7.6	Other
365	5.0	1	140.5	196.0	1.00	Merrimack River-Shawsheen River to mouth	2.5	3.1	1.8	1.8	11.4	0.0	13.2	Priority
366	27.1	2	365.0	356.8	0.87	Merrimack River-Nashua River to Shawsheen River	2.3	3.3	15.9	15.9	7.2	0.0	23.1	High Priority
367	9.1	2	225.2	168.4	0.48	Spickett River	2.8	3.4	3.5	3.5	10.1	5.0	18.6	High Priority
368	5.2	2	176.5	23950.2	1.00	Souhegan River	2.8	3.4	2.0	2.0	7.8	5.0	14.8	Priority
369	36.1	4	285.8	7194.6	0.59	Merrimack River-Nashua River to Shawsheen River	3.1	3.4	6.8	6.8	4.5	5.0	16.4	High Priority
370	5.1	2	388.4	427.3	0.00	Merrimack River-Nashua River to Shawsheen River	2.7	3.3	1.8	1.8	3.0	5.0	9.8	Other
371	12.7	2	210.1	4817.5	0.77	Souhegan River	2.7	3.4	4.9	4.9	7.9	5.0	17.8	High Priority
372	11.6	4	797.6	518.4	0.43	Souhegan River	2.2	2.9	4.7	4.7	5.5	5.0	15.2	Priority
373	6.1	2	206.4	1721.7	0.00	Merrimack River-Shawsheen River to mouth	2.0	2.9	3.3	3.3	2.5	0.0	5.8	Other
374	10.9	2	904.0	159.6	0.96	Souhegan River	2.6	3.1	3.4	3.4	9.1	5.0	17.5	High Priority
375	15.3	2	132.4	246.3	0.89	Merrimack River-Shawsheen River to mouth	2.5	3.1	6.1	6.1	7.4	5.0	18.5	High Priority
376	21.5	4	184.2	5574.9	0.49	Souhegan River	2.7	3.4	9.8	9.8	5.6	10.0	25.4	High Priority
377	10.1	1	180.8	41.8	0.96	Merrimack River-Shawsheen River to mouth	2.7	3.4	4.3	4.3	7.9	5.0	17.2	High Priority
378	32.7	6	180.7	5571.1	0.68	Souhegan River	2.8	3.5	15.7	15.7	6.7	5.0	27.4	High Priority
379	6.9	1	771.7	273.5	0.63	Souhegan River	2.4	2.9	2.0	2.0	7.2	10.0	19.3	High Priority
380	9.6	2	181.8	4858.4	0.17	Souhegan River	2.5	3.4	5.2	5.2	7.5	5.0	17.7	High Priority
381	9.9	2	813.3	1433.4	0.93	Souhegan River	3.3	3.5	0.8	0.8	7.7	0.0	8.6	Other
382	9.6	1	174.4	139.5	0.39	Merrimack River-Shawsheen River to mouth	2.4	3.1	3.5	3.5	5.1	5.0	13.6	Priority
383	5.6	2	122.5	6437.8	0.23	Merrimack River-Shawsheen River to mouth	2.9	3.6	2.0	2.0	6.0	5.0	13.0	Priority
384	6.5	1	360.2	23.1	0.40	Spickett River	2.8	3.6	2.8	2.8	4.1	5.0	11.9	Priority
385	12.9	2	363.7	1302.4	0.93	Merrimack River-Nashua River to Shawsheen River	2.6	3.4	6.0	6.0	7.6	5.0	18.6	High Priority
386	5.4	2	225.6	416.5	0.70	Souhegan River	1.9	2.9	3.0	3.0	5.7	5.0	13.7	Priority
387	10.5	2	150.0	50.0	1.00	Merrimack River-Shawsheen River to mouth	2.7	3.4	4.4	4.4	9.3	5.0	18.7	High Priority
388	6.4	2	340.6	8.8	1.00	Merrimack River-Nashua River to Shawsheen River	2.7	3.4	3.0	3.0	7.9	5.0	15.9	Priority
389	6.8	1	275.3	31.6	0.54	Manchester Tributaries	2.6	3.4	3.0	3.0	5.0	0.0	8.0	Other
390	6.1	2	729.1	227.1	0.44	Souhegan River	2.2	2.9	2.8	2.8	10.1	5.0	17.9	High Priority
391	12.8	2	366.4	109.8	0.81	Merrimack River-Nashua River to Shawsheen River	3.2	4.0	5.8	5.8	7.8	5.0	18.6	High Priority
392	13.0	3	330.0	104.5	0.20	Manchester Tributaries	2.5	3.2	5.4	5.4	2.5	5.0	12.9	Priority
393	9.6	2	119.4	390.4	0.36	Merrimack River-Shawsheen River to mouth	2.4	3.0	3.8	3.8	4.6	5.0	13.4	Priority
394	7.7	1	742.3	180.8	0.56	Souhegan River	2.0	2.9	3.8	3.8	12.6	5.0	21.5	High Priority
395	5.1	1	275.1	31.8	1.00	Merrimack River-Shawsheen River to mouth	2.7	3.3	1.9	1.9	8.1	5.0	14.9	Priority
396	8.3	3	836.6	22.1	0.46	Souhegan River	3.1	3.9	3.9	3.9	4.1	0.0	8.1	Other
397	7.3	4	316.5	572.1	0.32	Manchester Tributaries	2.0	2.9	4.3	4.3	3.7	5.0	13.0	Priority
398	7.3	1	386.5	329.8	0.27	Merrimack River-Nashua River to Shawsheen River	2.4	3.2	3.2	3.2	3.3	0.0	6.4	Other
399	12.8	3	125.3	47.1	0.21	Merrimack River-Shawsheen River to mouth	2.7	3.5	5.7	5.7	3.1	0.0	8.8	Other
400	21.0	2	365.5	95.2	0.65	Merrimack River-Nashua River to Shawsheen River	2.7	3.4	9.4	9.4	5.8	5.0	20.2	High Priority
401	8.3	2	220.8	374.9	0.66	Manchester Tributaries	2.7	3.4	3.2	3.2	5.8	10.0	18.9	High Priority
402	8.5	1	157.4	53.0	0.59	Merrimack River-Shawsheen River to mouth	2.5	3.2	3.1	3.1	5.4	5.0	13.5	Priority
403	5.4	1	213.0	4396.5	0.53	Souhegan River	2.5	3.2	1.9	1.9	6.5	5.0	13.4	Priority
404	6.0	3	122.9	29.5	0.35	Merrimack River-Shawsheen River to mouth	2.7	3.4	2.6	2.6	8.5	5.0	16.1	High Priority
405	8.4	3	188.4	154.3	0.85	Manchester Tributaries	2.9	3.4	2.6	2.6	7.6	5.0	15.2	Priority

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Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
406	17.5	4	395.1	599.8	0.35	Merrimack River-Nashua River to Shawsheen River	2.7	3.2	5.0	5.0	3.6	0.0	8.6	Other
407	30.5	4	121.6	221.2	0.76	Merrimack River-Shawsheen River to mouth	2.7	3.4	14.0	14.0	8.2	0.0	22.2	High Priority
408	10.2	2	124.4	34.4	0.68	Merrimack River-Shawsheen River to mouth	2.8	3.6	4.9	4.9	6.0	5.0	15.9	Priority
409	20.6	4	667.1	510.3	0.66	Piscataquog River	2.5	3.1	8.5	8.5	7.6	5.0	21.1	High Priority
410	10.0	5	122.9	24.4	0.62	Merrimack River-Shawsheen River to mouth	3.1	3.7	4.6	4.6	13.3	5.0	22.9	High Priority
411	10.8	2	127.2	49.8	0.69	Merrimack River-Shawsheen River to mouth	2.4	3.1	4.6	4.6	6.4	5.0	16.0	Priority
412	15.5	4	276.2	2557.9	0.70	Souhegan River	2.9	3.3	4.1	4.1	5.9	5.0	15.0	Priority
413	13.2	1	128.9	21.5	0.94	Merrimack River-Shawsheen River to mouth	2.7	3.5	5.7	5.7	7.7	5.0	18.4	High Priority
414	13.3	3	404.8	3367.1	1.00	Souhegan River	2.5	3.0	4.4	4.4	19.3	5.0	28.7	High Priority
415	5.2	1	843.9	43.1	0.09	Souhegan River	2.5	3.1	1.9	1.9	2.2	0.0	4.1	Other
416	22.7	4	146.9	1752.1	0.36	Merrimack River-Shawsheen River to mouth	2.6	3.2	8.7	8.7	4.9	5.0	18.6	High Priority
417	8.0	1	144.0	114.4	1.00	Merrimack River-Shawsheen River to mouth	2.9	3.5	2.6	2.6	9.2	5.0	16.8	High Priority
418	6.0	1	362.9	30.5	0.71	Souhegan River	2.3	3.2	2.9	2.9	7.8	5.0	15.7	Priority
419	11.6	1	146.5	2016.4	0.39	Merrimack River-Shawsheen River to mouth	2.7	3.3	3.8	3.8	5.1	5.0	13.9	Priority
420	8.0	1	240.2	116.9	0.35	Manchester Tributaries	2.7	3.4	3.1	3.1	2.7	0.0	5.9	Other
421	6.2	1	297.1	2510.8	0.00	Souhegan River	3.1	3.3	0.5	0.5	0.9	0.0	1.5	Other
422	5.7	3	166.0	22.8	1.00	Merrimack River-Shawsheen River to mouth	3.6	4.0	1.4	1.4	8.8	5.0	15.3	Priority
423	5.2	2	158.7	937.8	0.95	Merrimack River-Shawsheen River to mouth	3.4	3.6	0.8	0.8	9.7	5.0	15.6	Priority
424	12.8	1	229.8	61.3	0.36	Manchester Tributaries	3.1	3.7	4.2	4.2	3.5	5.0	12.6	Priority
425	8.1	3	503.0	137.7	0.70	Merrimack River-Nashua River to Shawsheen River	2.2	2.9	3.5	3.5	13.1	5.0	21.7	High Priority
426	17.6	2	228.7	113.0	0.05	Manchester Tributaries	2.6	3.2	6.5	6.5	0.9	0.0	7.4	Other
427	6.1	4	291.1	914.6	0.67	Cohas Brook	2.6	3.1	1.8	1.8	6.3	0.0	8.0	Other
428	7.9	4	325.6	229.5	0.00	Souhegan River	2.7	2.9	1.5	1.5	0.6	0.0	2.1	Other
429	11.8	2	233.9	3948.2	0.60	Souhegan River	2.4	3.3	6.3	6.3	5.4	5.0	16.7	High Priority
430	9.1	2	276.9	1051.5	0.40	Cohas Brook	3.0	3.3	1.3	1.3	4.4	5.0	10.8	Other
431	6.3	5	314.6	2423.2	0.00	Souhegan River	2.5	3.1	2.6	2.6	0.9	0.0	3.5	Other
432	7.7	3	247.3	106.8	0.12	Manchester Tributaries	2.7	3.3	3.2	3.2	1.3	0.0	4.4	Other
433	5.5	3	766.1	124.3	1.00	Piscataquog River	2.3	3.0	2.6	2.6	9.5	0.0	12.0	Priority
434	10.2	1	724.2	75.6	0.41	Souhegan River	2.7	3.3	3.0	3.0	12.0	5.0	20.1	High Priority
435	10.5	3	248.3	29.5	0.16	Manchester Tributaries	2.8	3.6	5.5	5.5	1.6	0.0	7.0	Other
436	5.9	3	232.9	363.4	0.00	Manchester Tributaries	2.4	3.1	2.6	2.6	0.5	0.0	3.1	Other
437	19.9	1	385.0	1430.7	0.70	Merrimack River-Nashua River to Shawsheen River	3.3	3.5	2.3	2.3	8.3	5.0	15.7	Priority
438	9.1	2	177.5	324.7	0.29	Merrimack River-Shawsheen River to mouth	2.3	3.1	4.1	4.1	3.4	0.0	7.5	Other
439	6.1	2	647.7	782.0	0.98	Souhegan River	2.5	3.1	1.9	1.9	15.4	5.0	22.3	High Priority
440	7.6	1	251.1	140.5	0.59	Cohas Brook	2.5	3.3	3.0	3.0	5.7	0.0	8.8	Other
441	9.9	1	199.8	1806.8	0.46	Manchester Tributaries	2.9	3.4	2.8	2.8	4.6	0.0	7.3	Other
442	6.3	1	210.8	26.7	0.37	Cohas Brook	2.8	3.4	2.3	2.3	3.9	0.0	6.2	Other
443	6.2	3	199.1	21.5	0.79	Cohas Brook	3.0	3.6	2.5	2.5	7.3	0.0	9.7	Other
444	12.5	1	206.9	36.4	1.00	Manchester Tributaries	2.7	3.5	5.5	5.5	8.1	5.0	18.6	High Priority
445	5.1	2	552.8	243.7	0.00	Piscataquog River	2.8	3.2	1.2	1.2	1.7	0.0	2.9	Other
446	14.1	2	258.3	241.4	0.00	Manchester Tributaries	2.6	3.3	6.0	6.0	1.5	0.0	7.5	Other
447	12.4	1	418.7	2016.8	1.00	Concord Tributaries	2.2	2.9	4.7	4.7	9.7	0.0	14.4	Priority
448	5.2	1	529.1	110.0	0.66	Piscataquog River	2.7	3.4	2.3	2.3	5.9	0.0	8.1	Other
449	8.0	1	1029.0	88.1	0.08	Piscataquog River	2.4	3.3	3.7	3.7	2.0	0.0	5.7	Other
450	9.6	1	571.2	18.4	0.38	Suncook River	2.7	3.4	3.5	3.5	4.0	5.0	12.5	Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
451	7.7	1	405.2	22233.9	0.17	Suncook River	2.9	3.4	2.0	2.0	2.3	0.0	4.3	Other
452	6.2	1	336.1	12.7	0.00	Suncook River	3.2	3.6	1.6	1.6	1.2	0.0	2.8	Other
453	6.2	1	360.7	15.7	0.00	Suncook River	3.1	3.6	1.6	1.6	1.2	0.0	2.9	Other
454	7.6	2	341.2	24807.4	0.18	Suncook River	3.1	3.6	2.2	2.2	2.5	5.0	9.7	Other
455	17.2	3	437.5	19557.9	0.24	Suncook River	3.3	3.5	1.9	1.9	8.8	5.0	15.8	Priority
456	5.1	1	286.4	11.5	0.98	Soucook River	3.5	3.9	1.4	1.4	9.4	5.0	15.8	Priority
457	5.0	2	554.8	2087.0	0.60	Suncook River	2.3	3.0	2.1	2.1	7.1	0.0	9.2	Other
458	6.0	2	235.9	16.6	0.76	Concord Tributaries	2.5	3.3	2.6	2.6	13.2	5.0	20.8	High Priority
459	14.6	4	452.2	466.0	1.00	Upper Merrimack River	2.9	3.2	2.7	2.7	8.1	0.0	10.8	Priority
460	5.7	2	267.1	6346.6	0.85	Upper Merrimack River	2.6	3.3	2.2	2.2	8.0	5.0	15.2	Priority
461	5.8	2	774.9	3101.9	1.00	Upper Suncook River	2.6	3.3	2.5	2.5	16.3	5.0	23.8	High Priority
462	6.7	1	638.4	47.0	0.44	Concord Tributaries	2.7	3.3	2.1	2.1	4.4	0.0	6.5	Other
463	11.0	1	768.0	31.4	0.42	Suncook River	2.5	3.3	5.0	5.0	4.6	10.0	19.6	High Priority
464	6.2	1	537.5	14.1	0.00	Upper Suncook River	2.9	3.7	2.6	2.6	1.5	0.0	4.1	Other
465	10.3	4	725.4	2075.0	1.00	Suncook River	2.4	2.9	3.6	3.6	10.0	10.0	23.6	High Priority
466	10.1	3	791.6	753.8	0.64	Suncook River	2.3	2.9	4.2	4.2	10.4	5.0	19.6	High Priority
467	10.0	2	290.5	138.3	0.95	Upper Merrimack River	2.4	3.1	3.9	3.9	8.5	10.0	22.4	High Priority
468	12.6	1	873.8	131.7	0.64	Upper Suncook River	2.4	3.2	5.4	5.4	7.7	0.0	13.1	Priority
469	5.4	1	213.5	9309.2	0.00	Cohas Brook	2.1	3.0	2.8	2.8	1.5	0.0	4.3	Other
470	6.4	3	218.7	38.5	0.55	Cohas Brook	3.3	3.8	2.0	2.0	5.2	0.0	7.2	Other
471	61.5	4	198.2	43533.3	0.81	Cohas Brook	3.0	3.4	15.7	15.7	6.7	0.0	22.4	High Priority
472	8.9	2	888.8	36.4	0.13	Piscataquog River	2.4	3.2	4.4	4.4	2.9	0.0	7.2	Other
473	13.4	5	276.8	694.8	0.70	Cohas Brook	2.1	3.0	8.2	8.2	6.4	0.0	14.6	Priority
474	24.5	4	207.7	382.1	0.51	Cohas Brook	3.4	3.7	5.4	5.4	4.8	0.0	10.2	Other
475	11.7	3	198.5	207.8	1.00	Cohas Brook	3.1	3.7	4.7	4.7	8.2	5.0	17.9	High Priority
476	14.1	1	253.4	29701.3	0.08	Cohas Brook	3.3	3.4	1.2	1.2	2.8	10.0	14.0	Priority
477	8.8	2	589.8	20.7	0.40	Piscataquog River	2.8	3.4	3.0	3.0	4.3	5.0	12.3	Priority
478	13.1	1	212.9	458.0	0.00	Cohas Brook	2.6	3.4	5.3	5.3	0.2	5.0	10.5	Other
479	5.2	1	244.5	1985.7	0.00	Manchester Tributaries	2.3	3.0	2.0	2.0	1.5	0.0	3.5	Other
480	13.2	2	306.3	192.8	0.64	Cohas Brook	2.7	3.2	3.9	3.9	5.7	5.0	14.7	Priority
481	5.9	1	775.1	20.0	0.57	Piscataquog River	2.6	3.3	2.2	2.2	8.2	10.0	20.5	High Priority
482	12.6	2	358.2	499.0	1.00	Manchester Tributaries	2.6	3.4	5.6	5.6	10.8	0.0	16.4	High Priority
483	6.4	1	434.6	752.2	0.44	Souhegan River	2.1	2.9	2.7	2.7	4.7	0.0	7.4	Other
484	6.2	3	314.8	33.7	1.00	Cohas Brook	2.5	3.2	2.7	2.7	8.6	5.0	16.3	High Priority
485	9.6	3	236.4	926.3	0.35	Cohas Brook	2.7	3.4	4.2	4.2	3.3	10.0	17.5	High Priority
486	8.6	2	139.9	144.3	0.00	Manchester Tributaries	2.5	3.4	4.4	4.4	1.1	0.0	5.4	Other
487	6.6	2	303.4	14.1	0.32	Cohas Brook	2.6	3.5	3.5	3.5	3.4	0.0	6.9	Other
488	6.2	2	261.9	736.3	0.31	Manchester Tributaries	2.9	3.3	1.7	1.7	2.4	0.0	4.1	Other
489	5.2	1	269.9	158.4	0.00	Cohas Brook	2.2	2.9	2.0	2.0	1.5	0.0	3.5	Other
490	10.8	2	245.1	824.0	0.83	Cohas Brook	2.9	3.4	3.0	3.0	7.2	10.0	20.2	High Priority
491	14.0	3	246.2	2024.3	0.45	Manchester Tributaries	2.6	3.4	6.3	6.3	5.8	10.0	22.1	High Priority
492	8.0	1	335.0	66.2	0.00	Cohas Brook	2.7	3.4	3.3	3.3	1.5	0.0	4.8	Other
493	6.0	2	251.0	775.8	0.08	Manchester Tributaries	2.8	3.5	2.6	2.6	0.9	0.0	3.5	Other
494	8.4	4	252.6	1733.0	0.58	Manchester Tributaries	2.9	3.5	3.6	3.6	4.9	5.0	13.4	Priority
495	15.6	1	325.4	433.3	0.80	Cohas Brook	2.5	3.1	4.6	4.6	7.4	0.0	12.0	Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
496	19.3	1	288.0	545.2	0.76	Cohas Brook	2.5	3.0	5.2	5.2	5.9	5.0	16.1	High Priority
497	5.1	1	668.0	49.1	0.32	Souhegan River	2.7	3.3	1.8	1.8	3.5	0.0	5.3	Other
498	7.6	2	901.0	422.9	0.98	Piscataquog River	2.2	3.1	3.9	3.9	9.4	5.0	18.3	High Priority
499	8.8	2	349.3	327.2	0.83	Manchester Tributaries	2.4	3.0	3.0	3.0	13.3	5.0	21.3	High Priority
500	5.9	3	132.2	32.3	0.20	Piscataquog River	3.2	3.7	1.7	1.7	2.0	0.0	3.7	Other
501	16.7	3	626.4	91.1	1.00	Piscataquog River	2.8	3.4	5.6	5.6	11.3	0.0	16.9	High Priority
502	15.0	1	672.3	811.9	0.74	Piscataquog River	2.4	3.2	6.3	6.3	13.8	5.0	25.1	High Priority
503	19.3	4	436.9	730.6	0.34	Piscataquog River	3.4	3.6	1.9	1.9	3.3	5.0	10.2	Other
504	8.1	2	285.9	161.6	0.00	Cohas Brook	2.5	3.2	3.3	3.3	1.4	5.0	9.7	Other
505	10.1	6	435.5	121.8	0.05	Cohas Brook	2.3	3.0	4.8	4.8	2.0	5.0	11.7	Priority
506	45.3	4	302.9	912.1	0.69	Manchester Tributaries	3.0	3.3	9.5	9.5	5.3	5.0	19.8	High Priority
507	8.7	1	613.8	509.2	0.46	Piscataquog River	2.5	3.3	3.4	3.4	5.4	0.0	8.8	Other
508	5.2	1	655.8	517.5	0.44	Piscataquog River	2.2	3.2	2.7	2.7	6.4	0.0	9.1	Other
509	13.3	3	614.1	4838.7	0.62	Piscataquog River	2.7	3.4	5.8	5.8	6.5	0.0	12.2	Priority
510	7.6	4	269.0	247.0	0.63	Cohas Brook	2.8	3.2	2.3	2.3	5.4	5.0	12.7	Priority
511	12.1	1	256.4	1449.4	0.51	Cohas Brook	2.8	3.5	4.8	4.8	11.6	5.0	21.3	High Priority
512	5.3	3	252.2	266.4	0.02	Cohas Brook	2.8	3.4	1.8	1.8	7.5	5.0	14.2	Priority
513	5.9	1	289.2	73.8	0.00	Cohas Brook	2.9	3.4	1.6	1.6	2.2	5.0	8.7	Other
514	7.3	2	254.7	18328.6	0.21	Cohas Brook	2.3	2.9	2.6	2.6	5.5	5.0	13.1	Priority
515	5.1	1	204.7	14025.1	0.26	Manchester Tributaries	2.6	3.2	1.8	1.8	9.1	5.0	15.8	Priority
516	5.0	1	252.5	9.4	1.00	Cohas Brook	3.5	3.9	1.2	1.2	14.8	5.0	21.0	High Priority
517	8.7	1	597.1	2834.8	0.23	Piscataquog River	3.1	3.5	1.8	1.8	10.6	5.0	17.4	High Priority
518	10.3	2	937.7	613.4	0.68	Piscataquog River	2.7	3.2	3.1	3.1	8.0	0.0	11.0	Priority
519	5.1	1	252.1	57.2	0.33	Manchester Tributaries	3.2	3.6	1.2	1.2	3.7	5.0	9.8	Other
520	7.5	1	299.5	26.5	0.68	Cohas Brook	2.9	3.5	2.5	2.5	5.3	5.0	12.9	Priority
521	8.5	2	604.7	616.2	0.36	Piscataquog River	2.9	3.3	2.0	2.0	8.3	5.0	15.3	Priority
522	10.9	1	1024.9	401.3	0.84	Piscataquog River	2.4	3.1	4.5	4.5	8.0	5.0	17.5	High Priority
523	6.9	2	978.5	502.0	0.00	Piscataquog River	3.1	3.5	1.3	1.3	1.5	0.0	2.7	Other
524	11.9	3	376.1	575.8	0.74	Manchester Tributaries	2.3	2.9	4.8	4.8	6.4	0.0	11.2	Priority
525	25.8	2	259.3	1393.3	0.61	Cohas Brook	3.2	3.5	5.6	5.6	12.1	5.0	22.7	High Priority
526	8.0	2	380.5	124.5	0.51	Cohas Brook	3.5	3.7	1.0	1.0	4.5	0.0	5.5	Other
527	5.5	2	240.2	28.8	0.91	Manchester Tributaries	3.6	3.8	0.6	0.6	7.5	10.0	18.2	High Priority
528	9.3	2	316.7	864.8	0.00	Manchester Tributaries	2.3	2.9	3.2	3.2	0.7	0.0	3.8	Other
529	10.9	2	241.0	5113.8	0.79	Piscataquog River	2.9	3.4	3.1	3.1	7.0	5.0	15.1	Priority
530	12.2	1	298.4	47.8	0.91	Piscataquog River	3.1	3.9	5.7	5.7	12.0	5.0	22.7	High Priority
531	6.6	1	235.6	79.8	1.00	Manchester Tributaries	2.7	3.5	2.8	2.8	9.8	5.0	17.5	High Priority
532	22.5	1	1042.2	163.0	0.43	Piscataquog River	2.6	3.2	8.0	8.0	4.3	0.0	12.3	Priority
533	14.4	2	730.5	1936.8	0.52	Piscataquog River	3.0	3.2	1.4	1.4	5.9	0.0	7.2	Other
534	18.7	2	632.2	420.8	0.83	Piscataquog River	3.4	3.5	1.7	1.7	11.1	5.0	17.8	High Priority
535	6.7	2	372.5	74.3	1.00	Piscataquog River	2.8	3.6	3.0	3.0	8.4	5.0	16.4	High Priority
536	10.8	3	298.9	4016.0	0.73	Cohas Brook	2.9	3.1	1.0	1.0	7.1	5.0	13.1	Priority
537	11.2	3	301.0	46.3	0.52	Piscataquog River	3.2	3.9	4.6	4.6	11.1	5.0	20.7	High Priority
538	6.9	2	180.2	2008.6	0.00	Manchester Tributaries	3.1	3.4	1.0	1.0	0.8	0.0	1.8	Other
539	5.2	1	378.6	20198.3	0.74	Piscataquog River	2.6	3.4	2.2	2.2	6.7	0.0	8.9	Other
540	5.3	1	310.8	482.9	0.42	Cohas Brook	2.9	3.3	1.3	1.3	5.1	0.0	6.3	Other

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
541	18.8	1	378.8	19917.2	0.95	Piscataquog River	2.7	3.5	8.8	8.8	8.1	0.0	16.9	High Priority
542	20.9	3	894.9	857.2	0.52	Piscataquog River	2.3	3.0	9.1	9.1	6.9	0.0	16.0	Priority
543	5.3	2	319.5	142.3	0.33	Piscataquog River	3.0	3.5	1.9	1.9	7.7	5.0	14.5	Priority
544	6.2	2	336.4	409.6	0.01	Cohas Brook	2.9	3.5	2.5	2.5	0.8	5.0	8.3	Other
545	58.3	4	452.5	2252.5	0.65	Piscataquog River	2.9	3.6	27.3	27.3	7.2	0.0	34.5	High Priority
546	14.7	1	388.3	122.2	1.00	Piscataquog River	2.9	3.4	4.0	4.0	8.1	0.0	12.1	Priority
547	11.1	1	354.0	138.1	0.18	Cohas Brook	2.1	2.8	4.4	4.4	3.5	0.0	7.9	Other
548	5.2	1	418.3	3869.1	0.14	Piscataquog River	2.7	3.2	1.4	1.4	2.4	0.0	3.8	Other
549	10.0	2	856.6	114.2	0.28	Piscataquog River	2.4	3.2	5.1	5.1	3.7	0.0	8.8	Other
550	7.7	1	374.5	174.4	0.00	Cohas Brook	2.4	3.1	2.9	2.9	1.7	5.0	9.6	Other
551	5.6	3	315.5	792.1	0.49	Manchester Tributaries	2.4	3.0	2.3	2.3	4.5	0.0	6.8	Other
552	17.3	1	947.9	104.9	1.00	Piscataquog River	3.5	3.7	1.5	1.5	12.9	5.0	19.4	High Priority
553	5.6	3	852.6	17.1	1.00	Piscataquog River	3.0	3.6	2.2	2.2	10.1	0.0	12.3	Priority
554	8.2	3	854.1	3564.4	1.00	Piscataquog River	2.6	3.2	3.4	3.4	10.1	0.0	13.5	Priority
555	6.1	1	466.6	367.8	1.00	Piscataquog River	2.4	3.0	2.2	2.2	8.1	0.0	10.4	Other
556	18.8	1	491.9	134.7	0.99	Cohas Brook	2.6	3.3	6.8	6.8	8.1	5.0	19.9	High Priority
557	6.2	2	596.6	41.7	0.06	Piscataquog River	2.6	3.3	2.5	2.5	2.1	5.0	9.6	Other
558	12.5	1	394.9	2508.1	0.99	Piscataquog River	3.0	3.7	4.9	4.9	7.9	0.0	12.9	Priority
559	17.0	1	431.8	3368.7	0.82	Piscataquog River	2.6	3.3	6.6	6.6	8.4	5.0	20.0	High Priority
560	6.9	3	265.6	1019.1	0.97	Manchester Tributaries	3.1	3.4	1.3	1.3	7.9	0.0	9.2	Other
561	21.7	1	1032.3	312.0	0.87	Piscataquog River	2.5	3.2	8.8	8.8	14.7	5.0	28.5	High Priority
562	5.2	2	996.4	178.9	0.33	Piscataquog River	2.3	3.1	2.6	2.6	4.7	5.0	12.3	Priority
563	5.6	2	415.6	6304.5	1.00	Cohas Brook	2.3	3.0	2.5	2.5	16.1	5.0	23.6	High Priority
564	10.9	2	282.5	174.8	0.72	Manchester Tributaries	2.7	3.3	3.7	3.7	5.6	5.0	14.2	Priority
565	5.1	2	368.3	57.9	0.60	Piscataquog River	2.8	3.4	1.9	1.9	5.8	5.0	12.6	Priority
566	6.0	1	451.5	3461.1	0.32	Manchester Tributaries	2.5	3.2	2.2	2.2	5.0	0.0	7.1	Other
567	7.8	2	596.9	152.7	1.00	Piscataquog River	3.2	3.4	1.0	1.0	11.9	0.0	12.9	Priority
568	7.2	3	560.0	1120.7	1.00	Piscataquog River	3.0	3.2	1.0	1.0	10.0	5.0	16.1	Priority
569	12.3	2	507.2	745.5	0.82	Cohas Brook	2.6	3.2	4.7	4.7	12.2	5.0	21.9	High Priority
570	41.4	3	557.3	874.7	0.97	Manchester Tributaries	2.4	2.8	11.5	11.5	9.1	0.0	20.7	High Priority
571	11.7	1	619.4	61.4	1.00	Manchester Tributaries	3.3	3.8	2.9	2.9	11.1	5.0	19.0	High Priority
572	5.6	4	507.3	60.9	1.00	Manchester Tributaries	2.5	3.3	2.9	2.9	9.3	0.0	12.2	Priority
573	18.6	3	521.5	161.6	0.86	Cohas Brook	2.8	3.5	7.8	7.8	9.4	0.0	17.2	High Priority
574	16.6	2	655.5	7562.0	1.00	Piscataquog River	2.7	3.6	8.1	8.1	9.7	0.0	17.8	High Priority
575	8.1	2	487.1	104.4	1.00	Manchester Tributaries	3.0	3.7	3.4	3.4	16.1	5.0	24.5	High Priority
576	15.6	2	536.7	651.7	0.98	Manchester Tributaries	2.5	3.2	6.0	6.0	9.2	0.0	15.2	Priority
577	5.8	2	655.0	7714.6	1.00	Piscataquog River	2.7	3.5	2.9	2.9	9.7	0.0	12.5	Priority
578	22.1	3	485.7	4689.5	0.93	Manchester Tributaries	2.8	3.5	9.2	9.2	15.5	5.0	29.7	High Priority
579	8.7	1	502.4	158.9	0.53	Manchester Tributaries	2.4	3.1	3.2	3.2	5.0	5.0	13.2	Priority
580	10.8	2	246.2	648.9	0.73	Manchester Tributaries	3.2	3.4	1.1	1.1	6.2	0.0	7.2	Other
581	7.0	3	521.2	81.4	1.00	Manchester Tributaries	2.7	3.5	3.3	3.3	9.3	0.0	12.6	Priority
582	25.5	1	319.9	576.5	0.48	Manchester Tributaries	2.2	3.1	12.7	12.7	4.7	0.0	17.4	High Priority
583	6.2	3	717.8	376.8	1.00	Piscataquog River	3.0	3.6	2.3	2.3	14.4	5.0	21.8	High Priority
584	6.4	2	685.6	77.5	0.52	Piscataquog River	2.7	3.3	2.4	2.4	5.9	0.0	8.3	Other
585	5.8	2	657.7	552.5	1.00	Piscataquog River	2.8	3.4	2.2	2.2	9.7	0.0	11.9	Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
586	5.5	2	850.4	49.3	0.73	Piscataquog River	2.5	3.1	1.9	1.9	8.4	5.0	15.3	Priority
587	6.5	3	274.4	1584.0	0.48	Manchester Tributaries	2.3	3.0	2.6	2.6	4.1	0.0	6.7	Other
588	7.4	1	678.8	112.8	1.00	Piscataquog River	2.6	3.2	2.7	2.7	8.0	5.0	15.7	Priority
589	9.8	1	630.5	125.7	0.27	Piscataquog River	3.7	3.8	0.9	0.9	3.3	0.0	4.1	Other
590	6.9	1	776.9	19.6	0.64	Manchester Tributaries	2.6	3.4	3.0	3.0	5.7	0.0	8.7	Other
591	5.5	1	322.0	38.8	0.23	Manchester Tributaries	3.3	3.4	0.5	0.5	3.0	0.0	3.5	Other
592	6.5	1	682.8	167.6	1.00	Manchester Tributaries	2.4	3.1	2.4	2.4	8.1	0.0	10.5	Other
593	7.7	2	669.3	55.6	0.96	Manchester Tributaries	2.5	3.3	3.6	3.6	10.4	0.0	14.0	Priority
594	5.1	2	959.0	15.5	1.00	Piscataquog River	2.7	3.4	2.0	2.0	16.3	5.0	23.3	High Priority
595	5.1	2	959.6	73.1	1.00	Piscataquog River	2.6	3.4	2.5	2.5	16.3	5.0	23.8	High Priority
596	5.6	1	415.3	13.6	1.00	Manchester Tributaries	2.6	3.4	2.4	2.4	7.4	0.0	9.8	Other
597	8.4	3	498.4	1087.8	1.00	Manchester Tributaries	2.9	3.2	1.9	1.9	16.4	5.0	23.3	High Priority
598	10.2	5	309.1	1124.4	0.33	Manchester Tributaries	3.0	3.4	2.9	2.9	3.9	0.0	6.8	Other
599	6.8	1	621.9	649.9	1.00	Manchester Tributaries	2.3	3.0	2.6	2.6	8.8	0.0	11.4	Priority
600	9.5	1	562.8	2633.2	0.87	Piscataquog River	2.6	3.3	3.8	3.8	7.2	5.0	16.0	Priority
601	5.8	3	710.0	59.5	0.76	Manchester Tributaries	2.5	3.3	2.9	2.9	7.2	0.0	10.1	Other
602	14.7	1	445.5	476.9	0.83	Manchester Tributaries	2.3	3.0	5.6	5.6	9.1	5.0	19.7	High Priority
603	5.2	1	688.6	382.6	0.73	Manchester Tributaries	2.4	2.9	1.5	1.5	5.8	5.0	12.4	Priority
604	6.2	1	237.7	6.9	0.68	Manchester Tributaries	2.6	3.3	2.3	2.3	6.0	0.0	8.3	Other
605	32.7	1	536.4	207.5	1.00	Suncook River	3.1	3.5	7.2	7.2	14.1	5.0	26.3	High Priority
606	9.2	1	566.6	20558.3	0.09	Piscataquog River	2.6	3.2	3.0	3.0	1.7	5.0	9.7	Other
607	7.5	2	339.0	36.0	0.97	Manchester Tributaries	2.4	3.2	3.5	3.5	8.5	0.0	12.0	Priority
608	5.4	2	328.0	14.5	0.31	Manchester Tributaries	2.4	3.2	2.5	2.5	5.1	0.0	7.5	Other
609	7.2	1	697.3	230.1	1.00	Manchester Tributaries	2.2	2.9	3.0	3.0	11.1	5.0	19.1	High Priority
610	5.4	1	417.4	105.1	1.00	Concord Tributaries	2.7	3.5	2.2	2.2	10.5	5.0	17.6	High Priority
611	29.8	2	208.9	224.8	1.00	Manchester Tributaries	3.0	3.4	7.0	7.0	8.4	0.0	15.4	Priority
612	5.6	1	417.4	61.1	1.00	Suncook River	2.5	3.2	2.4	2.4	8.1	0.0	10.5	Other
613	6.5	1	910.7	53.3	0.43	Piscataquog River	2.5	3.3	2.5	2.5	6.2	5.0	13.7	Priority
614	6.3	3	297.5	531.6	0.00	Suncook River	2.1	2.9	2.8	2.8	0.8	0.0	3.6	Other
615	6.6	3	429.5	1268.8	0.56	Concord Tributaries	2.1	2.8	2.9	2.9	6.8	0.0	9.7	Other
616	5.3	1	654.3	118.1	1.00	Piscataquog River	2.8	3.5	2.0	2.0	10.2	0.0	12.2	Priority
617	7.2	4	470.3	25.8	1.00	Piscataquog River	2.5	3.3	3.7	3.7	17.3	5.0	26.0	High Priority
618	17.0	1	279.1	162749.4	0.00	Suncook River	2.8	3.0	2.4	2.4	0.2	0.0	2.6	Other
619	8.4	1	298.6	36.7	0.00	Suncook River	2.3	3.0	3.1	3.1	1.2	0.0	4.3	Other
620	20.1	1	192.3	110.7	0.06	Concord Tributaries	3.3	3.5	3.2	3.2	1.9	0.0	5.1	Other
621	5.3	1	241.9	5082.9	0.64	Concord Tributaries	2.8	3.2	1.3	1.3	5.0	0.0	6.2	Other
622	5.2	1	390.7	32.5	0.63	Concord Tributaries	2.4	3.2	2.2	2.2	9.1	5.0	16.3	High Priority
623	5.4	1	568.6	177.6	1.00	Suncook River	2.1	3.0	2.5	2.5	12.1	0.0	14.6	Priority
624	8.8	2	528.2	324.0	0.57	Concord Tributaries	2.1	2.9	4.4	4.4	4.8	0.0	9.2	Other
625	5.7	1	413.9	31.8	0.51	Suncook River	2.7	3.4	2.4	2.4	4.1	0.0	6.5	Other
626	8.3	2	490.3	442.8	0.98	Suncook River	2.5	3.0	2.3	2.3	8.4	5.0	15.7	Priority
627	7.4	2	484.4	1219.2	1.00	Suncook River	2.8	3.4	2.8	2.8	19.3	5.0	27.1	High Priority
628	6.9	1	443.4	41.3	0.81	Piscataquog River	2.8	3.4	2.5	2.5	6.9	5.0	14.4	Priority
629	9.1	1	313.1	777.1	0.39	Suncook River	2.5	3.0	2.7	2.7	3.9	0.0	6.6	Other
630	5.6	2	471.0	111.9	1.00	Suncook River	2.0	2.7	2.4	2.4	9.3	0.0	11.7	Priority

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631	14.9	3	207.5	160.9	1.00	Concord Tributaries	2.7	3.6	8.2	8.2	11.1	0.0	19.3	High Priority
632	7.3	3	317.6	655.9	0.82	Suncook River	2.5	3.1	2.6	2.6	6.7	0.0	9.3	Other
633	5.9	1	429.0	217.7	0.00	Concord Tributaries	2.5	3.3	2.5	2.5	1.5	5.0	9.0	Other
634	12.6	3	359.4	81.6	0.23	Concord Tributaries	2.4	3.2	6.1	6.1	4.4	0.0	10.5	Other
635	13.2	3	290.4	2787.1	1.00	Suncook River	3.2	3.5	2.3	2.3	9.4	0.0	11.7	Priority
636	9.5	1	378.9	427.3	0.60	Concord Tributaries	2.3	2.9	3.3	3.3	6.0	5.0	14.3	Priority
637	17.8	2	390.3	592.0	0.54	Concord Tributaries	2.5	3.2	7.5	7.5	5.2	5.0	17.7	High Priority
638	5.5	1	341.5	18.4	0.00	Concord Tributaries	2.8	3.4	1.8	1.8	1.1	0.0	2.9	Other
639	10.2	4	298.0	2734.5	0.72	Suncook River	3.0	3.2	1.9	1.9	7.5	5.0	14.4	Priority
640	10.3	2	349.0	313.9	1.00	Concord Tributaries	2.4	3.0	4.1	4.1	9.5	0.0	13.6	Priority
641	6.1	1	389.0	637.2	1.00	Suncook River	2.5	3.2	2.4	2.4	8.1	0.0	10.6	Other
642	9.3	2	302.2	2630.5	0.65	Suncook River	3.0	3.3	1.7	1.7	5.5	0.0	7.3	Other
643	7.8	2	339.3	2572.9	0.97	Concord Tributaries	2.7	3.3	2.9	2.9	11.1	5.0	19.0	High Priority
644	5.9	3	386.4	87.0	0.93	Concord Tributaries	2.9	3.7	2.8	2.8	15.1	5.0	22.9	High Priority
645	13.8	1	308.5	10515.0	0.80	Suncook River	3.5	3.7	1.6	1.6	13.7	5.0	20.3	High Priority
646	16.8	1	305.1	234.0	0.61	Soucook River	2.6	3.2	6.0	6.0	6.1	5.0	17.1	High Priority
647	5.1	1	327.2	336.5	0.99	Concord Tributaries	3.3	3.6	0.8	0.8	14.7	5.0	20.5	High Priority
648	5.8	2	346.5	2191.0	1.00	Suncook River	2.5	3.2	2.4	2.4	11.1	5.0	18.5	High Priority
649	26.5	3	217.1	58801.6	0.62	Soucook River	3.0	3.4	5.5	5.5	5.5	0.0	11.0	Priority
650	13.3	2	298.9	10686.2	0.99	Suncook River	3.4	3.7	2.5	2.5	14.3	5.0	21.7	High Priority
651	6.0	1	309.1	25.1	0.95	Suncook River	3.3	3.9	1.9	1.9	14.2	5.0	21.1	High Priority
652	5.3	3	395.1	1866.1	1.00	Concord Tributaries	2.6	3.2	2.1	2.1	14.4	5.0	21.5	High Priority
653	5.8	1	444.1	22.6	0.36	Concord Tributaries	2.4	3.3	2.6	2.6	3.9	0.0	6.5	Other
654	5.9	3	298.0	10.4	0.94	Suncook River	3.6	4.0	1.5	1.5	7.6	5.0	14.0	Priority
655	6.1	1	668.9	6.9	0.00	Soucook River	2.8	3.4	2.2	2.2	1.5	0.0	3.7	Other
656	7.6	2	660.6	19.8	0.00	Soucook River	2.7	3.4	2.9	2.9	1.7	0.0	4.6	Other
657	6.4	1	460.1	227.4	0.00	Concord Tributaries	2.2	2.9	2.5	2.5	1.5	5.0	9.0	Other
658	5.8	1	345.1	1527.8	0.00	Suncook River	2.5	3.2	2.1	2.1	2.2	5.0	9.3	Other
659	8.6	2	477.7	209.4	0.60	Concord Tributaries	2.1	2.9	3.6	3.6	5.5	0.0	9.1	Other
660	21.2	1	279.8	291.9	0.49	Concord Tributaries	2.9	3.2	3.9	3.9	10.9	5.0	19.8	High Priority
661	9.3	1	468.2	1069.1	0.68	Concord Tributaries	2.4	3.1	3.4	3.4	7.6	5.0	16.0	Priority
662	7.8	1	281.5	47.7	0.24	Concord Tributaries	2.5	3.2	2.8	2.8	2.7	5.0	10.5	Other
663	11.5	1	622.8	21.5	0.28	Soucook River	2.5	3.4	5.5	5.5	3.3	0.0	8.8	Other
664	8.5	1	619.7	438.1	0.60	Suncook River	2.3	2.9	3.1	3.1	5.5	0.0	8.5	Other
665	21.0	1	282.2	62.9	0.88	Concord Tributaries	2.6	3.2	7.5	7.5	7.7	5.0	20.1	High Priority
666	22.3	3	286.2	54.7	0.29	Concord Tributaries	2.3	3.2	12.4	12.4	8.4	5.0	25.8	High Priority
667	5.4	1	308.3	326.8	0.82	Soucook River	2.4	3.1	2.0	2.0	6.9	5.0	14.0	Priority
668	9.6	3	557.9	89.5	0.78	Suncook River	2.8	3.4	3.8	3.8	7.1	0.0	10.9	Priority
669	5.0	1	285.1	24.9	0.00	Concord Tributaries	2.4	3.3	2.5	2.5	6.0	5.0	13.5	Priority
670	18.6	1	283.5	20449.0	0.97	Concord Tributaries	2.6	3.0	3.4	3.4	13.6	5.0	22.0	High Priority
671	24.0	1	285.9	93.8	1.00	Concord Tributaries	2.6	3.3	9.4	9.4	13.8	5.0	28.2	High Priority
672	44.7	1	285.9	313.4	0.67	Concord Tributaries	2.3	3.0	18.8	18.8	11.0	10.0	39.9	High Priority
673	7.5	1	298.6	11.7	0.99	Concord Tributaries	2.4	3.3	3.5	3.5	8.1	5.0	16.6	High Priority
674	19.7	1	528.0	160.9	0.36	Concord Tributaries	3.1	3.3	1.8	1.8	4.3	0.0	6.1	Other
675	20.1	1	286.1	19567.2	0.90	Concord Tributaries	3.1	3.2	1.8	1.8	7.5	5.0	14.3	Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
676	12.2	1	296.7	67.4	0.63	Concord Tributaries	2.5	3.3	5.6	5.6	5.7	5.0	16.3	High Priority
677	5.5	1	550.0	96.2	1.00	Concord Tributaries	2.5	3.3	2.3	2.3	8.1	5.0	15.5	Priority
678	8.2	1	632.0	19.4	0.00	Suncook River	2.5	3.3	3.5	3.5	1.4	0.0	5.0	Other
679	13.3	1	626.3	154.8	0.00	Suncook River	2.4	3.0	4.4	4.4	2.8	0.0	7.2	Other
680	7.0	2	304.2	28.8	0.51	Suncook River	3.2	3.6	1.8	1.8	5.1	0.0	6.9	Other
681	7.6	2	499.1	69.0	0.33	Concord Tributaries	2.8	3.4	2.9	2.9	9.0	5.0	16.9	High Priority
682	7.3	1	460.0	82.6	0.34	Concord Tributaries	2.7	3.5	3.1	3.1	9.9	10.0	23.0	High Priority
683	8.7	3	655.1	1322.0	1.00	Suncook River	2.3	2.9	3.0	3.0	12.4	5.0	20.5	High Priority
684	11.7	4	304.7	131042.0	1.00	Suncook River	3.4	3.7	2.4	2.4	8.2	0.0	10.6	Other
685	8.0	2	225.5	330.9	1.00	Concord Tributaries	2.8	3.5	3.3	3.3	8.3	5.0	16.6	High Priority
686	7.7	1	667.8	1416.2	0.00	Suncook River	2.1	2.8	2.8	2.8	3.4	0.0	6.2	Other
687	7.0	1	513.1	561.8	1.00	Soucook River	2.8	3.3	2.1	2.1	9.6	0.0	11.7	Priority
688	15.3	3	314.8	164.0	0.99	Suncook River	3.5	3.8	2.6	2.6	8.6	10.0	21.2	High Priority
689	17.1	4	307.0	1701.4	0.90	Suncook River	2.8	3.5	8.0	8.0	7.8	10.0	25.8	High Priority
690	9.4	1	647.2	30.4	0.90	Suncook River	2.7	3.3	3.3	3.3	7.2	5.0	15.5	Priority
691	5.2	1	320.0	44.5	0.55	Suncook River	2.8	3.6	2.3	2.3	4.8	5.0	12.0	Priority
692	6.0	1	559.2	1497.8	0.25	Suncook River	2.3	3.1	2.7	2.7	3.7	0.0	6.3	Other
693	5.7	1	741.4	14.8	1.00	Suncook River	2.5	3.3	2.4	2.4	8.1	0.0	10.6	Other
694	7.9	1	621.1	37.1	0.00	Suncook River	2.6	3.3	2.9	2.9	1.8	0.0	4.7	Other
695	5.2	2	646.1	76.6	0.44	Suncook River	2.4	3.1	2.2	2.2	5.0	0.0	7.2	Other
696	5.3	1	716.0	130.0	1.00	Suncook River	2.4	3.2	2.4	2.4	10.3	0.0	12.6	Priority
697	5.5	1	224.0	6.2	0.38	Concord Tributaries	2.9	3.5	1.9	1.9	4.0	0.0	5.9	Other
698	12.5	2	341.4	102854.6	0.48	Suncook River	2.7	3.3	4.3	4.3	4.1	0.0	8.4	Other
699	9.9	3	329.4	27.7	0.79	Soucook River	2.8	3.5	4.6	4.6	7.7	5.0	17.3	High Priority
700	5.1	3	554.1	5624.9	0.00	Suncook River	2.7	3.1	1.3	1.3	1.9	0.0	3.2	Other
701	7.6	2	364.0	171.8	0.44	Soucook River	2.7	3.4	3.0	3.0	5.0	0.0	7.9	Other
702	6.1	3	230.8	4409.6	1.00	Concord Tributaries	2.8	3.2	1.5	1.5	14.5	10.0	26.0	High Priority
703	11.1	1	233.0	45.0	1.00	Concord Tributaries	2.3	3.2	5.3	5.3	13.0	5.0	23.3	High Priority
704	18.4	3	233.6	1017.6	0.54	Concord Tributaries	2.2	2.9	7.8	7.8	11.3	10.0	29.2	High Priority
705	10.2	1	232.6	269.3	1.00	Concord Tributaries	2.8	3.5	4.2	4.2	14.1	10.0	28.3	High Priority
706	6.2	2	360.1	938.8	0.94	Suncook River	2.6	3.1	2.1	2.1	8.4	0.0	10.5	Other
707	15.1	2	321.5	3655.3	0.66	Concord Tributaries	2.5	3.0	4.2	4.2	6.7	5.0	15.9	Priority
708	22.0	1	502.5	456.6	1.00	Suncook River	2.2	3.0	9.6	9.6	12.4	5.0	27.0	High Priority
709	22.4	1	237.9	187.9	0.74	Concord Tributaries	2.7	3.5	9.2	9.2	12.6	5.0	26.8	High Priority
710	10.9	1	320.1	465.4	0.55	Soucook River	2.8	3.4	3.7	3.7	5.7	10.0	19.4	High Priority
711	9.7	1	238.8	44.1	1.00	Concord Tributaries	2.8	3.5	3.8	3.8	14.3	5.0	23.0	High Priority
712	7.0	1	316.0	114.8	0.28	Concord Tributaries	2.4	3.2	2.7	2.7	3.3	0.0	6.1	Other
713	5.7	1	323.1	17.1	0.10	Concord Tributaries	2.7	3.3	2.1	2.1	3.0	0.0	5.1	Other
714	7.8	2	340.1	110.5	0.99	Suncook River	3.3	3.8	2.3	2.3	7.7	0.0	10.0	Other
715	6.3	1	504.9	27.0	0.19	Suncook River	2.4	3.3	3.0	3.0	2.8	0.0	5.8	Other
716	16.2	2	328.9	169.3	1.00	Concord Tributaries	2.5	3.1	6.3	6.3	10.8	5.0	22.1	High Priority
717	11.8	3	351.6	275.4	0.86	Concord Tributaries	2.3	3.0	4.9	4.9	8.7	10.0	23.6	High Priority
718	5.3	4	353.4	46.6	1.00	Concord Tributaries	2.4	3.2	2.8	2.8	9.0	10.0	21.8	High Priority
719	5.1	1	391.0	9.9	0.52	Soucook River	2.5	3.2	2.2	2.2	5.0	0.0	7.2	Other
720	6.5	3	326.5	311.6	0.68	Concord Tributaries	2.2	2.9	2.8	2.8	12.3	10.0	25.2	High Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
721	6.4	4	344.5	1322.8	0.00	Suncook River	3.4	3.6	0.8	0.8	1.0	0.0	1.9	Other
722	5.1	1	337.6	552.5	0.00	Concord Tributaries	2.0	2.7	1.9	1.9	0.2	0.0	2.1	Other
723	16.8	2	575.9	89.0	0.35	Suncook River	2.7	3.3	6.5	6.5	4.7	0.0	11.2	Priority
724	7.7	1	843.1	17.1	1.00	Suncook River	2.5	3.3	3.3	3.3	8.1	5.0	16.4	High Priority
725	8.2	2	792.3	169.0	1.00	Suncook River	2.4	3.2	4.0	4.0	12.4	0.0	16.4	High Priority
726	9.2	3	715.7	354.9	1.00	Suncook River	2.2	2.8	3.8	3.8	16.8	5.0	25.6	High Priority
727	17.0	2	737.5	87.2	0.32	Suncook River	2.4	3.2	7.7	7.7	4.7	0.0	12.4	Priority
728	16.1	2	867.5	75.9	0.48	Suncook River	2.4	3.1	6.3	6.3	8.2	0.0	14.4	Priority
729	6.4	1	514.3	98.5	0.98	Soucook River	2.6	3.4	2.8	2.8	8.5	0.0	11.3	Priority
730	10.6	1	763.4	86.2	0.02	Suncook River	2.3	3.0	4.2	4.2	2.7	0.0	6.8	Other
731	8.8	1	681.2	51.6	0.16	Suncook River	2.3	3.3	4.6	4.6	2.6	0.0	7.2	Other
732	5.4	1	732.6	20.0	0.00	Suncook River	2.3	3.2	2.8	2.8	1.5	5.0	9.3	Other
733	9.1	3	873.1	53.3	1.00	Suncook River	2.5	3.2	4.3	4.3	10.0	10.0	24.2	High Priority
734	12.3	3	835.0	85.3	0.32	Suncook River	2.6	3.2	4.5	4.5	3.5	0.0	8.0	Other
735	17.1	1	407.3	93.4	0.21	Concord Tributaries	2.6	3.4	7.1	7.1	3.4	5.0	15.5	Priority
736	10.4	1	466.5	37.6	0.48	Suncook River	2.5	3.3	4.8	4.8	4.7	10.0	19.5	High Priority
737	15.0	3	343.2	97784.4	1.00	Suncook River	3.1	3.6	4.3	4.3	8.3	0.0	12.6	Priority
738	8.4	1	371.0	94.1	0.14	Concord Tributaries	2.5	3.3	3.8	3.8	8.8	5.0	17.6	High Priority
739	8.4	1	373.2	70.1	0.29	Soucook River	2.8	3.4	2.8	2.8	3.4	0.0	6.2	Other
740	8.5	1	363.3	45.0	1.00	Concord Tributaries	2.6	3.4	3.9	3.9	13.3	10.0	27.2	High Priority
741	7.5	3	249.3	23.5	0.98	Concord Tributaries	3.2	3.5	1.6	1.6	9.0	5.0	15.6	Priority
742	8.6	1	352.4	119.0	0.88	Concord Tributaries	2.6	3.2	3.3	3.3	7.4	10.0	20.7	High Priority
743	7.6	1	673.5	21.9	0.26	Soucook River	2.4	3.2	3.3	3.3	4.5	0.0	7.8	Other
744	23.4	3	249.6	45.6	1.00	Concord Tributaries	2.7	3.6	12.9	12.9	9.1	0.0	22.0	High Priority
745	6.9	2	372.0	2132.2	0.01	Suncook River	2.5	3.3	3.2	3.2	1.5	0.0	4.7	Other
746	7.3	2	377.4	12.0	0.00	Suncook River	2.6	3.4	3.4	3.4	1.5	0.0	4.8	Other
747	6.3	1	423.7	42.2	1.00	Soucook River	2.8	3.4	2.2	2.2	8.1	0.0	10.4	Other
748	10.9	2	460.8	26.7	0.55	Concord Tributaries	2.7	3.4	4.6	4.6	5.5	5.0	15.1	Priority
749	8.8	5	379.2	1992.7	0.46	Suncook River	2.3	3.0	4.5	4.5	4.5	0.0	9.0	Other
750	11.8	1	385.2	69.6	0.76	Concord Tributaries	2.6	3.5	5.4	5.4	6.5	5.0	16.9	High Priority
751	7.2	2	380.9	1140.1	0.15	Soucook River	3.1	3.5	1.6	1.6	2.5	0.0	4.0	Other
752	5.8	1	271.9	21.7	0.00	Concord Tributaries	2.2	3.1	2.9	2.9	1.5	0.0	4.4	Other
753	12.3	1	394.8	659.3	0.33	Soucook River	3.0	3.4	3.0	3.0	3.6	0.0	6.6	Other
754	5.5	2	265.5	6.4	0.00	Upper Merrimack River	2.8	3.5	2.1	2.1	1.2	0.0	3.3	Other
755	5.0	1	253.7	12.9	0.20	Upper Merrimack River	2.7	3.3	1.5	1.5	3.7	10.0	15.2	Priority
756	11.2	1	354.0	14.1	0.96	Concord Tributaries	2.6	3.2	4.0	4.0	9.9	5.0	18.9	High Priority
757	7.9	2	802.2	207.6	1.00	Suncook River	2.4	3.0	2.9	2.9	9.6	0.0	12.5	Priority
758	9.6	1	777.2	1074.6	0.76	Upper Suncook River	3.1	3.3	0.8	0.8	8.0	0.0	8.8	Other
759	6.8	3	253.0	10.9	0.84	Upper Merrimack River	3.2	3.5	1.3	1.3	13.6	5.0	19.9	High Priority
760	5.2	4	333.5	3190.9	0.12	Concord Tributaries	2.3	3.0	2.5	2.5	5.3	5.0	12.8	Priority
761	7.6	3	462.5	1831.4	0.99	Suncook River	2.3	2.9	2.9	2.9	8.5	0.0	11.4	Priority
762	11.9	2	249.2	49.8	1.00	Upper Merrimack River	3.1	3.5	2.6	2.6	8.1	5.0	15.8	Priority
763	7.0	2	558.9	887.3	0.37	Suncook River	2.2	2.8	2.6	2.6	5.6	10.0	18.2	High Priority
764	16.1	1	513.0	2694.1	0.51	Soucook River	2.5	3.2	6.3	6.3	5.6	0.0	11.9	Priority
765	8.9	2	505.5	245.6	0.61	Suncook River	2.3	2.9	3.2	3.2	7.3	0.0	10.5	Other

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Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
766	10.3	1	417.6	877.2	1.00	Concord Tributaries	2.4	3.0	3.7	3.7	16.3	5.0	25.0	High Priority
767	67.7	3	417.7	2039.9	0.94	Concord Tributaries	2.6	3.3	28.2	28.2	14.9	5.0	48.1	High Priority
768	5.7	1	499.3	17.7	0.00	Suncook River	2.4	3.2	2.3	2.3	0.9	0.0	3.2	Other
769	21.4	1	439.9	63.6	0.96	Soucook River	3.0	3.6	7.6	7.6	8.4	10.0	26.0	High Priority
770	16.9	2	366.2	2936.7	0.54	Concord Tributaries	2.6	3.2	6.7	6.7	6.5	0.0	13.2	Priority
771	5.7	1	657.8	14.3	1.00	Suncook River	2.5	3.3	2.4	2.4	8.1	0.0	10.6	Other
772	6.7	2	533.6	2372.0	0.00	Soucook River	2.6	2.9	1.5	1.5	3.9	0.0	5.4	Other
773	23.1	2	252.6	228.5	0.60	Upper Merrimack River	3.1	3.4	4.1	4.1	5.9	5.0	15.0	Priority
774	9.7	1	836.1	20.7	0.00	Upper Suncook River	2.5	3.3	4.2	4.2	7.5	10.0	21.7	High Priority
775	7.4	1	687.1	10.1	0.10	Upper Suncook River	2.5	3.2	3.2	3.2	2.2	0.0	5.3	Other
776	14.0	1	395.4	574.2	1.00	Upper Merrimack River	2.0	2.9	6.6	6.6	9.4	0.0	16.0	Priority
777	5.5	1	556.4	39.7	1.00	Soucook River	2.5	3.3	2.4	2.4	8.1	5.0	15.5	Priority
778	5.8	1	711.7	36.4	0.43	Upper Suncook River	2.5	3.3	2.5	2.5	4.4	0.0	6.8	Other
779	6.4	2	552.2	70.8	0.45	Soucook River	2.5	3.1	2.2	2.2	6.9	0.0	9.1	Other
780	8.4	3	672.7	326.7	0.00	Suncook River	2.2	2.8	3.1	3.1	2.1	0.0	5.2	Other
781	9.1	2	577.2	81.8	0.83	Suncook River	2.7	3.5	4.1	4.1	7.2	0.0	11.3	Priority
782	6.5	1	653.1	649.2	1.00	Upper Suncook River	2.5	3.1	2.1	2.1	15.9	5.0	23.0	High Priority
783	14.3	1	679.1	46.3	1.00	Suncook River	2.5	3.3	6.1	6.1	8.1	0.0	14.3	Priority
784	7.3	1	393.0	52.8	1.00	Upper Merrimack River	2.7	3.5	3.1	3.1	8.1	0.0	11.3	Priority
785	6.2	1	691.1	15.0	0.62	Soucook River	2.5	3.3	2.6	2.6	5.6	0.0	8.3	Other
786	7.5	1	376.5	654.4	1.00	Concord Tributaries	2.3	3.0	2.9	2.9	9.6	0.0	12.4	Priority
787	6.4	1	702.2	15.5	0.27	Suncook River	2.3	3.2	2.9	2.9	3.2	0.0	6.2	Other
788	5.8	1	620.4	30.5	0.54	Suncook River	2.5	3.3	2.7	2.7	6.5	0.0	9.2	Other
789	8.8	1	406.0	33041.8	0.99	Soucook River	2.7	3.3	2.9	2.9	7.9	5.0	15.8	Priority
790	5.8	3	484.0	66.6	0.64	Upper Merrimack River	2.6	3.2	2.1	2.1	6.9	5.0	14.0	Priority
791	5.4	1	423.1	14.7	1.00	Soucook River	2.8	3.6	2.4	2.4	8.1	5.0	15.5	Priority
792	5.3	3	540.0	1038.6	1.00	Soucook River	2.7	3.1	1.2	1.2	10.5	0.0	11.7	Priority
793	14.1	1	567.8	534.8	0.34	Suncook River	2.2	2.9	5.5	5.5	3.8	0.0	9.3	Other
794	9.3	3	752.9	23.0	1.00	Upper Suncook River	2.6	3.2	3.5	3.5	8.8	0.0	12.4	Priority
795	8.9	4	435.0	1728.4	0.15	Concord Tributaries	2.9	3.2	2.1	2.1	8.0	5.0	15.0	Priority
796	16.1	1	457.5	2375.7	0.29	Concord Tributaries	2.7	3.4	5.8	5.8	5.5	5.0	16.3	High Priority
797	6.1	2	534.7	4158.9	1.00	Suncook River	2.4	3.2	3.1	3.1	13.0	5.0	21.1	High Priority
798	9.0	1	417.3	19.6	0.00	Soucook River	2.9	3.5	3.0	3.0	1.5	0.0	4.5	Other
799	8.7	1	421.8	161.9	0.58	Upper Merrimack River	2.4	3.2	3.7	3.7	5.3	0.0	9.0	Other
800	13.4	3	258.9	217.0	1.00	Upper Merrimack River	3.1	3.6	3.8	3.8	16.1	5.0	24.9	High Priority
801	9.1	2	402.3	95.7	1.00	Soucook River	2.9	3.6	4.0	4.0	8.0	5.0	16.9	High Priority
802	10.5	1	546.2	324.7	1.00	Soucook River	2.0	2.8	4.6	4.6	9.5	0.0	14.0	Priority
803	15.1	1	622.9	184.5	0.07	Suncook River	2.2	3.0	5.9	5.9	1.9	0.0	7.9	Other
804	16.1	5	260.6	157.3	1.00	Upper Merrimack River	2.9	3.6	8.0	8.0	16.1	5.0	29.1	High Priority
805	6.4	1	262.2	16.2	1.00	Upper Merrimack River	3.2	3.8	2.1	2.1	15.5	5.0	22.5	High Priority
806	18.5	1	265.5	5021.1	0.76	Upper Merrimack River	2.6	3.3	7.0	7.0	12.5	5.0	24.5	High Priority
807	7.6	2	674.1	134.4	0.12	Suncook River	2.5	3.1	2.9	2.9	2.8	0.0	5.7	Other
808	6.6	1	542.0	8.7	0.55	Upper Merrimack River	2.4	3.2	3.0	3.0	5.2	0.0	8.2	Other
809	15.8	1	539.4	131.7	0.52	Upper Merrimack River	2.7	3.5	6.9	6.9	4.9	0.0	11.8	Priority
810	5.4	1	370.6	3312.6	0.00	Upper Merrimack River	3.0	3.3	0.9	0.9	0.6	0.0	1.5	Other

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Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
811	7.1	1	401.3	168.1	0.44	Soucook River	2.7	3.5	3.2	3.2	4.4	5.0	12.6	Priority
812	7.8	1	724.4	21.2	0.85	Suncook River	2.5	3.3	3.3	3.3	13.6	5.0	21.9	High Priority
813	33.4	1	256.8	214.4	0.01	Upper Merrimack River	3.0	3.5	10.4	10.4	8.9	10.0	29.2	High Priority
814	17.7	3	538.0	4660.9	0.85	Suncook River	2.3	2.8	5.6	5.6	8.5	0.0	14.1	Priority
815	17.4	3	539.9	4408.5	1.00	Suncook River	2.3	2.9	6.4	6.4	9.5	0.0	15.9	Priority
816	10.0	1	573.3	119.9	1.00	Concord Tributaries	2.4	3.0	3.3	3.3	10.1	0.0	13.3	Priority
817	6.7	4	274.4	369.0	0.58	Upper Merrimack River	2.6	3.2	3.1	3.1	12.6	5.0	20.7	High Priority
818	5.8	2	503.2	51.9	0.44	Concord Tributaries	2.6	3.5	2.8	2.8	5.2	5.0	13.0	Priority
819	10.8	2	525.3	909.7	0.00	Upper Suncook River	2.4	3.0	4.2	4.2	3.1	0.0	7.3	Other
820	9.3	3	423.1	244.0	0.35	Upper Merrimack River	2.5	3.1	3.8	3.8	5.3	0.0	9.1	Other
821	9.6	2	558.0	21.4	0.89	Upper Suncook River	2.9	3.6	3.9	3.9	9.1	0.0	13.0	Priority
822	14.9	2	559.7	1650.7	1.00	Concord Tributaries	2.5	3.1	5.7	5.7	9.9	5.0	20.6	High Priority
823	7.3	1	419.2	30.2	0.46	Soucook River	2.9	3.6	3.0	3.0	10.3	10.0	23.2	High Priority
824	5.8	1	282.3	152.0	1.00	Upper Merrimack River	2.2	3.0	2.6	2.6	15.5	5.0	23.1	High Priority
825	8.5	3	788.5	40.3	1.00	Suncook River	2.5	3.3	4.0	4.0	12.8	10.0	26.8	High Priority
826	5.5	2	798.6	10.1	0.18	Suncook River	2.4	3.3	2.9	2.9	6.2	10.0	19.1	High Priority
827	6.9	1	582.3	11.7	0.61	Suncook River	2.6	3.4	3.0	3.0	5.6	0.0	8.5	Other
828	8.7	4	559.8	2967.2	1.00	Suncook River	2.2	2.9	4.0	4.0	11.0	5.0	20.0	High Priority
829	5.2	1	661.8	12.2	0.57	Suncook River	2.4	3.2	2.4	2.4	5.3	0.0	7.7	Other
830	6.9	1	800.9	30.4	0.01	Suncook River	2.5	3.3	3.2	3.2	1.5	0.0	4.7	Other
831	5.2	1	623.5	14.1	0.98	Suncook River	2.5	3.3	2.2	2.2	8.0	0.0	10.2	Other
832	7.9	1	824.9	12.7	0.78	Suncook River	2.5	3.3	3.6	3.6	6.7	5.0	15.3	Priority
833	6.6	5	746.6	285.5	1.00	Suncook River	2.6	3.2	2.9	2.9	10.0	10.0	23.0	High Priority
834	6.6	1	607.3	3195.7	0.27	Soucook River	2.3	3.0	2.4	2.4	5.1	5.0	12.6	Priority
835	6.3	1	681.7	13.6	0.73	Suncook River	2.5	3.3	2.7	2.7	6.4	0.0	9.0	Other
836	5.8	1	620.8	2331.4	1.00	Suncook River	2.3	3.0	2.1	2.1	8.1	0.0	10.2	Other
837	28.1	5	748.2	1571.6	0.79	Suncook River	2.6	3.2	12.8	12.8	7.3	5.0	25.1	High Priority
838	6.9	1	445.8	2765.8	0.75	Soucook River	2.3	3.2	3.5	3.5	8.3	10.0	21.8	High Priority
839	10.3	4	429.4	2204.6	1.00	Upper Merrimack River	2.9	3.5	4.4	4.4	9.1	5.0	18.5	High Priority
840	9.5	1	743.3	27.2	1.00	Suncook River	2.5	3.3	4.1	4.1	11.7	5.0	20.8	High Priority
841	5.1	1	900.0	29.5	1.00	Suncook River	2.5	3.3	2.2	2.2	8.1	0.0	10.3	Other
842	8.0	1	837.7	14.7	0.12	Soucook River	2.4	3.2	3.7	3.7	2.3	0.0	6.0	Other
843	6.6	3	429.5	4974.4	0.68	Upper Merrimack River	2.7	3.4	2.7	2.7	6.9	5.0	14.7	Priority
844	7.3	1	766.3	1256.1	0.35	Suncook River	2.6	3.2	2.6	2.6	4.1	0.0	6.7	Other
845	8.6	1	461.0	2613.2	0.99	Soucook River	2.2	3.2	4.5	4.5	12.7	5.0	22.2	High Priority
846	5.7	1	908.5	36.4	1.00	Suncook River	2.6	3.3	2.1	2.1	8.1	0.0	10.2	Other
847	5.6	2	581.7	801.6	0.16	Upper Suncook River	2.5	3.1	2.2	2.2	3.1	0.0	5.3	Other
848	7.7	3	949.2	34.6	0.98	Upper Suncook River	2.5	3.3	4.0	4.0	9.5	5.0	18.4	High Priority
849	12.0	1	576.2	7732.3	0.78	Soucook River	2.2	3.0	5.6	5.6	6.7	0.0	12.3	Priority
850	5.7	1	789.3	590.8	0.36	Suncook River	2.1	2.8	2.2	2.2	3.9	5.0	11.0	Priority
851	6.1	1	269.5	1202.8	0.58	Upper Merrimack River	2.9	3.4	1.6	1.6	12.3	5.0	18.9	High Priority
852	9.2	2	499.1	1821.8	0.42	Soucook River	3.1	3.5	2.3	2.3	6.4	5.0	13.6	Priority
853	27.0	2	839.4	497.9	1.00	Suncook River	2.4	3.1	10.9	10.9	11.4	10.0	32.3	High Priority
854	12.5	4	616.3	907.9	0.27	Upper Suncook River	2.2	2.8	5.5	5.5	4.2	5.0	14.7	Priority
855	5.1	1	613.9	19.2	0.02	Upper Suncook River	2.5	3.3	2.2	2.2	1.6	0.0	3.8	Other

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
856	6.8	1	442.0	30.9	0.45	Upper Merrimack River	2.6	3.3	2.9	2.9	4.5	0.0	7.4	Other
857	7.7	1	664.3	22.8	0.49	Soucook River	2.5	3.2	3.0	3.0	6.0	0.0	9.0	Other
858	7.5	2	942.1	39.4	0.26	Upper Suncook River	2.4	3.1	3.2	3.2	3.5	0.0	6.6	Other
859	17.5	1	731.5	173.7	1.00	Soucook River	2.6	3.1	5.2	5.2	11.5	5.0	21.6	High Priority
860	5.5	3	671.3	7442.2	0.75	Soucook River	2.2	2.9	2.4	2.4	8.0	0.0	10.5	Other
861	6.1	2	946.6	80.9	0.00	Upper Suncook River	2.5	3.1	2.1	2.1	2.6	0.0	4.7	Other
862	14.2	2	676.8	7299.1	0.92	Soucook River	2.0	2.9	7.5	7.5	9.1	0.0	16.7	High Priority
863	14.0	2	883.2	19.4	0.53	Suncook River	2.5	3.3	6.7	6.7	6.9	0.0	13.6	Priority
864	9.6	5	569.1	604.0	0.06	Upper Suncook River	2.3	3.0	4.8	4.8	3.8	5.0	13.5	Priority
865	14.4	1	662.5	6994.9	0.87	Soucook River	2.1	2.9	6.8	6.8	7.3	0.0	14.0	Priority
866	6.5	1	681.6	169.2	1.00	Upper Merrimack River	2.8	3.4	2.1	2.1	7.6	0.0	9.7	Other
867	14.0	3	517.4	283.0	0.12	Soucook River	3.1	3.4	3.1	3.1	7.0	5.0	15.1	Priority
868	9.4	4	693.9	964.6	0.84	Upper Suncook River	2.1	2.9	4.7	4.7	8.8	0.0	13.6	Priority
869	7.4	2	662.5	102.6	0.00	Upper Suncook River	2.3	2.9	2.6	2.6	1.2	0.0	3.8	Other
870	10.8	1	675.7	108.9	0.00	Upper Suncook River	2.7	3.2	3.2	3.2	1.2	0.0	4.4	Other
871	12.8	3	735.8	408.4	0.80	Soucook River	2.4	3.1	5.6	5.6	9.9	0.0	15.5	Priority
872	11.5	1	379.7	3837.5	1.00	Upper Merrimack River	2.7	3.3	3.7	3.7	8.1	0.0	11.9	Priority
873	7.4	1	382.3	130.5	1.00	Upper Merrimack River	2.6	3.4	3.2	3.2	8.1	0.0	11.3	Priority
874	5.4	1	790.7	45.7	0.16	Soucook River	2.5	3.3	2.3	2.3	2.6	0.0	4.9	Other
875	7.0	2	681.2	206.6	0.36	Upper Suncook River	2.3	3.1	3.4	3.4	4.1	0.0	7.5	Other
876	5.5	1	935.1	48.2	0.00	Upper Suncook River	2.2	3.0	2.3	2.3	1.8	0.0	4.1	Other
877	6.0	2	896.4	1534.7	0.03	Soucook River	1.8	2.9	3.8	3.8	3.2	5.0	12.0	Priority
878	5.0	2	655.9	705.4	0.28	Upper Suncook River	2.1	2.9	2.4	2.4	5.3	0.0	7.7	Other
879	5.3	3	555.8	7.4	0.97	Upper Suncook River	2.7	3.4	2.5	2.5	9.2	0.0	11.8	Priority
880	12.1	4	558.2	1784.2	1.00	Upper Suncook River	2.3	3.2	7.1	7.1	9.4	0.0	16.5	High Priority
881	8.4	1	1026.3	18.9	0.83	Soucook River	2.5	3.2	3.3	3.3	8.2	5.0	16.5	High Priority
882	6.9	1	756.2	21.7	0.30	Upper Suncook River	2.6	3.3	3.0	3.0	5.5	0.0	8.5	Other
883	6.4	3	1174.8	63.9	0.04	Upper Suncook River	2.3	2.9	2.6	2.6	3.6	5.0	11.2	Priority
884	5.3	1	834.6	2268.4	0.07	Soucook River	2.4	2.9	1.6	1.6	2.7	0.0	4.3	Other
885	12.2	1	271.7	860.6	0.28	Upper Merrimack River	2.4	3.0	3.5	3.5	3.3	5.0	11.8	Priority
886	8.8	2	692.1	139.0	0.61	Upper Suncook River	2.4	2.9	2.8	2.8	6.0	0.0	8.8	Other
887	30.5	2	809.6	237.3	1.00	Upper Merrimack River	2.7	3.3	11.8	11.8	9.5	0.0	21.3	High Priority
888	11.6	1	275.8	363.7	0.26	Upper Merrimack River	2.5	2.9	3.0	3.0	3.2	5.0	11.2	Priority
889	5.8	2	634.5	367.1	0.24	Upper Merrimack River	2.4	3.1	2.2	2.2	3.5	0.0	5.8	Other
890	6.0	1	1001.3	8.5	0.00	Upper Merrimack River	2.5	3.3	2.6	2.6	1.5	0.0	4.0	Other
891	10.1	2	561.7	2399.6	0.00	Soucook River	2.3	3.1	4.6	4.6	5.4	5.0	15.0	Priority
892	6.3	3	572.1	54.9	1.00	Upper Suncook River	3.0	3.7	2.8	2.8	11.1	5.0	18.9	High Priority
893	7.0	3	557.6	488.7	0.00	Upper Merrimack River	2.7	3.4	2.8	2.8	2.5	0.0	5.3	Other
894	13.7	4	559.2	517.0	0.37	Soucook River	2.5	3.1	5.7	5.7	4.6	10.0	20.3	High Priority
895	12.1	2	266.1	246.8	0.59	Upper Merrimack River	2.9	3.4	4.1	4.1	10.4	5.0	19.5	High Priority
896	17.0	3	566.5	1920.9	0.92	Upper Merrimack River	2.7	3.4	7.5	7.5	8.7	5.0	21.1	High Priority
897	6.6	2	773.5	347.8	1.00	Upper Suncook River	2.3	2.9	2.3	2.3	10.8	0.0	13.1	Priority
898	6.8	1	630.3	17557.7	0.00	Upper Suncook River	2.5	3.1	2.2	2.2	2.2	0.0	4.4	Other
899	6.8	1	965.6	577.2	0.34	Soucook River	2.2	2.9	2.6	2.6	4.0	0.0	6.5	Other
900	29.4	4	621.0	1145.2	0.66	Soucook River	2.6	3.1	10.2	10.2	6.9	0.0	17.1	High Priority

Appendix D: Model Outputs

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901	8.9	2	709.8	1266.0	0.89	Upper Suncook River	2.2	2.9	3.9	3.9	9.4	5.0	18.3	High Priority
902	19.2	3	613.2	230.2	1.00	Upper Merrimack River	2.2	2.9	8.9	8.9	15.4	5.0	29.3	High Priority
903	15.7	3	857.0	103.5	0.70	Upper Suncook River	2.4	3.0	6.5	6.5	6.9	0.0	13.3	Priority
904	10.1	1	899.3	32.5	1.00	Upper Suncook River	2.5	3.3	4.3	4.3	8.1	0.0	12.5	Priority
905	5.3	3	882.5	351.0	0.21	Upper Suncook River	2.2	2.9	2.1	2.1	4.9	5.0	12.0	Priority
906	6.5	3	678.1	3549.4	0.14	Upper Suncook River	2.2	2.9	3.0	3.0	4.0	5.0	12.0	Priority
1001	5.3	2	229.9	51.9	0.00	Litchfield-Hudson Tributaries	2.7	3.4	2.1	2.1	2.7	5.0	9.9	Other
1002	15.5	2	142.2	321284.2	0.00	Manchester Tributaries	3.8	4.3	5.0	5.0	1.5	0.0	6.5	Other
1003	7.3	1	316.5	19.2	1.00	Merrimack River-Shawsheen River to mouth	2.7	3.6	3.5	3.5	8.5	5.0	17.0	High Priority
1004	7.8	1	714.4	38.0	0.69	Souhegan River	2.9	3.7	3.6	3.6	12.7	5.0	21.3	High Priority
1005	34.2	5	361.4	168.2	0.77	Merrimack River-Nashua River to Shawsheen River	3.6	4.1	11.5	11.5	8.1	0.0	19.7	High Priority
1006	32.6	2	125.7	445.7	0.19	Merrimack River-Nashua River to Shawsheen River	3.4	3.9	9.1	9.1	4.3	10.0	23.4	High Priority
1007	12.2	2	225.3	208.0	0.26	Merrimack River-Shawsheen River to mouth	3.5	4.2	4.7	4.7	5.7	5.0	15.4	Priority
1008	12.1	2	125.1	67.4	0.55	Merrimack River-Shawsheen River to mouth	2.8	3.6	5.1	5.1	4.5	5.0	14.6	Priority
1009	23.9	5	212.5	71.5	0.59	Merrimack River-Nashua River to Shawsheen River	3.4	4.0	9.3	9.3	10.6	5.0	24.9	High Priority
1010	41.9	4	374.4	967.2	0.82	Merrimack River-Nashua River to Shawsheen River	3.5	4.0	13.9	13.9	6.6	5.0	25.5	High Priority
1011	8.7	1	320.0	27.4	1.00	Spickett River	2.8	3.7	4.2	4.2	8.1	5.0	17.3	High Priority
1012	30.4	2	180.7	345.9	0.73	Souhegan River	3.1	3.6	10.2	10.2	11.2	5.0	26.4	High Priority
1013	17.7	5	204.6	96446.2	0.84	Souhegan River	3.5	4.0	5.7	5.7	6.8	5.0	17.5	High Priority
1014	5.6	1	154.8	2366.2	0.40	Manchester Tributaries	3.0	3.8	2.5	2.5	3.5	0.0	6.0	Other
1015	10.5	1	216.6	14374.7	0.00	Souhegan River	3.2	3.7	2.9	2.9	2.3	0.0	5.2	Other
1016	5.6	3	251.6	57.6	0.89	Cohas Brook	3.3	3.7	1.3	1.3	15.4	5.0	21.6	High Priority
1017	1.3	1	251.0	509.4	0.47	Cohas Brook	2.8	3.2	0.3	0.3	7.8	5.0	13.0	Priority
1018	0.6	1	253.8	13.9	0.83	Cohas Brook	2.7	3.1	0.1	0.1	12.5	5.0	17.6	High Priority
1019	1.1	2	251.2	408.1	0.48	Cohas Brook	3.6	3.8	0.2	0.2	9.0	5.0	14.2	Priority
1020	1.7	2	253.4	18.4	0.86	Cohas Brook	3.6	3.9	0.3	0.3	13.6	5.0	18.9	High Priority
1021	1.9	2	253.3	10.2	0.47	Cohas Brook	3.6	4.0	0.4	0.4	11.3	5.0	16.7	High Priority
1022	1.5	1	251.0	255.2	0.00	Cohas Brook	2.9	3.2	0.3	0.3	5.0	5.0	10.3	Other
1023	3.6	2	252.9	31.8	0.07	Cohas Brook	3.7	4.0	0.6	0.6	6.0	5.0	11.5	Priority
1024	2.2	3	255.9	8.7	0.51	Cohas Brook	3.5	3.8	0.4	0.4	12.8	5.0	18.2	High Priority
1025	7.2	2	252.3	64.3	0.39	Cohas Brook	3.4	3.7	1.1	1.1	8.4	5.0	14.5	Priority
1026	0.9	1	251.0	1.1	0.46	Cohas Brook	3.7	3.9	0.1	0.1	7.6	5.0	12.8	Priority
1027	2.1	1	252.3	4.4	0.43	Cohas Brook	3.5	3.8	0.3	0.3	7.2	5.0	12.5	Priority
1028	0.5	1	253.7	8.1	0.00	Cohas Brook	2.8	3.2	0.1	0.1	4.1	5.0	9.2	Other
1029	1.9	1	252.1	151.4	0.31	Cohas Brook	3.2	3.5	0.4	0.4	7.5	5.0	12.9	Priority
1030	3.5	1	251.0	68.5	0.70	Cohas Brook	3.5	3.8	0.6	0.6	10.8	5.0	16.4	High Priority
1031	2.3	1	254.2	1429.5	0.07	Cohas Brook	3.0	3.3	0.4	0.4	6.5	5.0	11.9	Priority
1032	0.5	1	256.7	0.5	0.00	Cohas Brook	2.8	3.1	0.1	0.1	3.4	5.0	8.5	Other
1033	4.1	2	254.0	17.5	0.46	Cohas Brook	3.7	4.0	0.6	0.6	8.8	5.0	14.4	Priority
1034	5.1	2	251.4	137.2	0.00	Cohas Brook	3.0	3.6	1.8	1.8	7.3	5.0	14.1	Priority
1035	0.9	1	251.4	28.3	0.00	Cohas Brook	2.5	2.8	0.2	0.2	4.0	5.0	9.2	Other
1036	0.8	1	251.3	2.6	0.56	Cohas Brook	2.4	2.8	0.2	0.2	8.9	5.0	14.1	Priority
1037	0.9	2	251.3	254.4	0.45	Cohas Brook	3.4	3.7	0.2	0.2	10.0	5.0	15.2	Priority
1038	1.1	1	255.2	1.2	0.00	Cohas Brook	2.4	2.8	0.2	0.2	6.2	5.0	11.4	Priority
1039	1.2	1	251.0	4.6	0.29	Cohas Brook	3.2	3.4	0.2	0.2	6.4	5.0	11.6	Priority

Appendix D: Model Outputs

Candidate Site	Site Acreage	NWI Classes	Average Site Elevation	Site Watershed Acres	Percent Unfragmented	HUC-10 Watershed Name	Existing FVI Score	Restored FVI Score	Normalized & Weighted NFB	Weighted FVI Score	Sustainability Score	Landscape Position Score	Total Prioritization Score	Category
1040	0.7	1	251.3	2.8	0.00	Cohas Brook	2.3	2.7	0.1	0.1	6.2	5.0	11.4	Priority
1041	1.7	2	251.3	254.4	0.51	Cohas Brook	3.4	3.7	0.3	0.3	10.9	5.0	16.1	High Priority
1042	1.5	1	252.9	10.1	0.73	Cohas Brook	2.4	2.8	0.3	0.3	11.2	5.0	16.5	High Priority
1043	0.5	1	292.0	0.7	1.00	Cohas Brook	1.9	2.9	0.2	0.2	14.8	5.0	20.1	High Priority
1044	6.7	3	338.0	102023.3	0.83	Suncook River	3.5	3.8	1.2	1.2	6.6	0.0	7.8	Other
1045	10.6	4	338.5	101636.6	0.33	Suncook River	3.6	3.8	1.5	1.5	3.3	0.0	4.8	Other

Appendix E

Conceptual Restoration Cost Estimates

VHB Vanasse Hangen Brustlin, Inc.
Six Bedford Farms Drive, Suite 607
Bedford, New Hampshire 03110

Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 5

Site Name: Jericho Road Pelham, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement	23.2	Acres	$1,000.00	$23,200.00	
	Permanent Easement	23.2	Acres	$10,000.00	$232,000.00	
						$255,200.00
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000.00
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	67.5	CY	$100.00	$6,750.00	
						$6,750.00
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0.00
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	46,464	SY	$1.00	$46,464.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$46,464.00
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	
						$0.00
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)	5,248	SF	$1.65	$8,659.53	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	15,021	SF	$1.65	$24,784.16	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	3,821	SF	$1.70	$6,495.87	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$39,939.56
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$2,090.88	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$1,626.24	$0.00	
						$0.00
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0.00
Subtotal Construction						**$353,353.56**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex	1	Contract	25%		$88,338.39
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	4	Weeks	$2,875.00		$11,500.00
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)	1	Project	5%		$17,667.68
TOTAL						**$470,859.62**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 6

Site Name: Beaver Brook Tributary Pelham, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	45	CY	$100.00	$4,500.00	
						$4,500
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$0
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	$10,000.00	$10,000.00	
						$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$450.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$350.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)	1	LS	$10,000.00	$10,000.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$10,000
Subtotal Construction						**$29,500**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex	1	Contract	25%		$4,425
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	1	Weeks	$2,875.00		$2,875
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$1,475
TOTAL						**$38,275**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 52

Site Name: Musquash Brook Headwater Hudson, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres		$0.00	
	Permanent Easement		Acres		$0.00	
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	45	CY	$100.00	$4,500.00	
						$4,500
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	#########	$10,000.00	$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$450.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$350.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	#########	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	#########	$0.00	
						$0
Subtotal Construction						$19,500
	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting,					
Task 10. Design & Permitting	Complex		Contract	25%		$2,925
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	0.5	Weeks	$2,875.00		$1,438
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$975
TOTAL						**$24,838**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 67

Site Name: Second Brook Swamp Hudson, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	########	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	30	CY	$100.00	$3,000.00	
						$3,000
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95		
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	########	$10,000.00	$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95		
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65		
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control					$0.00	
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$450.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$350.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	########	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	########	$0.00	
						$0
Subtotal Construction						$18,000
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$0
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)		Weeks	########		$0
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$0
TOTAL						**$18,000**

Notes:

1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 71

Site Name: Salmon Brook & Marsh Nashua, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement	1.5	Acres	$2,000.00	$3,000.00	
	Permanent Easement	1.5	Acres	$20,000.00	$30,000.00	
						$33,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	$10,000.00	$10,000.00	$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	12	LS	$450.00	$5,400.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$350.00	$0.00	
						$5,400
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)	3	LS	$25,000.00	$75,000.00	
						$75,000
Subtotal Construction						**$128,400**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$32,100
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	1	Weeks	$2,875.00		$2,875
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$6,420
TOTAL						**$169,795**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

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Six Bedford Farms Drive, Suite 607
Bedford, New Hampshire 03110

Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 76

Site Name: Tributary to Harris Brook Salem, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	########	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	37.5	CY	$100.00	########	
						$3,750
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Remove and Stockpile Existing Vegetation & Soils						
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control					$0.00	
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item		LS	$0.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$0.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$8,750**
	Consultant Fees for Final Survey, Geotechnical					
Task 9. Design & Permitting	Investigations, Design, and Permitting, Complex		Contract	25%		$1,313
Task 10. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)		Weeks	$2,875.00		$0
Task 11.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01		Project	5%		$438
TOTAL					$0	**$10,500**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 81

Site Name: Porcupine Brook Tributary Salem, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	15	CY	$100.00	$1,500.00	
						$1,500
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)	1,125	CY	$12.00	$13,500.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	1,125	CY	$10.00	$11,250.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)	1,125	SY	$1.00	$1,125.00	
						$25,875
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	72,600	CY	$10.00	$726,000.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	200,000	SY	$1.00	$200,000.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)	21,780	CY	$20.00	$435,600.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$1,361,600
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	
Task 7. Plantings						$0
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	74,052	SF	$1.80	$133,293.60	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)	13,500	SF	$2.05	$27,675.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$160,969
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$62,436.38	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$48,561.63	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
Subtotal Construction						**$1,554,944**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$233,242
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	5	Weeks	$2,875.00		$14,375
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$77,747
TOTAL						**$1,880,307**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site:134

Site Name: Farmed Wetlands Litchfield, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	$1,200.00	$0.00	
	Permanent Easement	260	Acres	#########	$2,600,000.00	
						$2,600,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)	15,100	CY	$12.00	$181,200.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	15,100	CY	$10.00	$151,000.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)	68,000	SY	$1.00	$68,000.00	
						$400,200
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	15,111	CY	$10.00	$151,111.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	$151,111
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	#########	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)	31,114	SF	$1.95	$60,672.89	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)	2,672	SF	$1.65	$4,409.46	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	545	SF	$1.70	$925.65	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	2,829	SF	$1.80	$5,091.48	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)	10,890	SF	$2.05	$22,324.50	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$93,424
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	#########	$24,809.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	#########	$19,295.89	
						$44,105
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)	1	LS	#########	$10,000.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	#########	$0.00	
						$10,000
Subtotal Construction						**$3,303,840**
Task 9. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$495,576
Task 10. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	10	Weeks	$2,875.00		$28,750
Task 11.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$165,192
TOTAL						**$3,993,358**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 218

Site Name: Nesenkeag Brook Headwater Londonderry, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)		LS	$5,000.00	$0.00	
					$0.00	$0
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00		
						$0
Task 4. New Channel Shaping/Stream Restoration					$0.00	
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
					$0.00	$0
Task 5. Wetland Restoration					$0.00	
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00		
Remove and Stockpile Existing Vegetation & Soils						
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	$10,000.00	$10,000.00	$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$450.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$350.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0.00
Subtotal Construction						**$10,000**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$1,500
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)		Weeks	$2,875.00		$0
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$500
TOTAL					$0	**$12,000**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 231

Site Name: Hartshorn Brook Milford, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement	0.25	Acres	$1,200.00	$300.00	
	Permanent Easement	34.2	Acres	$10,000.00	$342,000.00	
						$342,300
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	30	CY	$100.00	$3,000.00	
						$3,000
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$0
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)	15,300	CY	$8.00	$122,400.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29	5,100	CY	$20.00	$102,000.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$224,400
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)	17,400	SF	$1.65	$28,710.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	108,900	SF	$1.65	$179,685.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	156,800	SF	$1.70	$266,560.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)	435,600	SF	$0.20	$87,120.00	
						$562,075
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$10,098.00	$10,098.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$7,854.00	$7,854.00	
						$17,952
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$1,154,727**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$173,209
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	4	Weeks	$2,875.00		$11,500
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$57,736
TOTAL						**$1,397,172**

Notes:

1 - Construction estimate completed using 2008 dollars.

2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*

3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.

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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 273

Site Name: Farmed Wetlands Litchfield, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement	0.25	Acres	$1,000.00	$250.00	
	Permanent Easement	34.2	Acres	$10,000.00	$342,000.00	
						$342,250
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	30	CY	$100.00	$3,000.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$3,000
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)	55,000	CY	$8.00	$440,000.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	55,000	CY	$10.00	$550,000.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	135,000	SY	$1.00	$135,000.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)	46,000	CY	$20.00	$920,000.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$2,045,000
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	25,000	SF	$1.65	$41,250.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	120,000	SF	$1.70	$204,000.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$245,250
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$92,160.00	$92,160.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$71,680.00	$71,680.00	
						$163,840
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$2,804,340**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$420,651
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	7	Weeks	$2,875.00		$20,125
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$140,217
TOTAL						**$3,385,333**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 295

Site Name: Hoodkroft Country Club Derry, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	0.5	Acres	$15,000.00	$7,500.00	
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	30	CY	$100.00	$3,000.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$3,000
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	$10,000.00	$10,000.00	$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$585.00	$585.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$455.00	$455.00	
						$1,040
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)	1	LS	$25,000.00	$25,000.00	
						$25,000
Subtotal Construction						**$44,040**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$6,606
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)		Weeks	$2,875.00		$0
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$2,202
TOTAL						**$52,848**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 348

Site Name: Hog Hill Swamp East Kingston, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	20	Acres	$12,000.00	$240,000.00	
						$240,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$0
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)	6,000	CY	$8.00	$48,000.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29	6,000	CY	$20.00	$120,000.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$168,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	4,491	SF	$1.70	$7,634.19	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$7,634
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$7,560.00	$7,560.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$5,880.00	$5,880.00	
						$13,440
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$434,074**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$65,111
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	1	Weeks	$2,875.00		$2,875
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$21,704
TOTAL					$0	**$523,764**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 366

Site Name: Beaver Brook Tibutary Salem, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	90	CY	$100.00	$9,000.00	
						$9,000
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00		
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00		
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00		
Remove and Stockpile Existing Vegetation & Soils						
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00		
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00		
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95		
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00		
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95		
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	$10,000.00	$10,000.00	
						$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95		
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65		
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65		
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70		
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80		
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05		
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70		
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20		
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$450.00	$450.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$350.00	$350.00	
						$800
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00		
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00		
Subtotal Construction					$24,800	**$24,800**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$3,720
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	1.5	Weeks	$2,875.00		$4,313
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$1,240
TOTAL						**$34,073**

Notes:

1 - Construction estimate completed using 2008 dollars.

2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*

3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.

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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 371

Site Name: McQuade Brook, Bedford, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	$12,000.00	$0.00	
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	67.5	CY	$100.00	$6,750.00	
						$6,750
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)	22,022	CY	$8.00	$176,176.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	44,044	SY	$1.00	$44,044.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)	3,509	CY	$20.00	$70,180.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$290,400
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	15,791	SF	$1.65	$26,054.33	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	30,008	SF	$1.70	$51,013.60	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$77,068
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$13,068.00	$13,068.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$10,164.00	$10,164.00	
						$23,232
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$402,450**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$60,367
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	4	Weeks	$2,875.00		$11,500
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$20,122
TOTAL						**$494,440**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 378

Site Name: Riddle Brook Wetlands Bedford & Merrimack, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	10	Acres	$12,000.00	$120,000.00	
						$120,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	15	CY	$100.00	$1,500.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$1,500
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)	24,800	CY	$8.00	$198,400.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	24,800	CY	$10.00	$248,000.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	8,300	SY	$1.00	$8,300.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)	1,800	CY	$20.00	$36,000.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$490,700
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	$10,000.00	$10,000.00	$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)	10,890	SF	$1.95	$21,235.50	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)	5,886	SF	$1.65	$9,712.56	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	14,520	SF	$1.80	$26,136.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$57,084
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$22,599.00	$22,599.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$17,577.00	$17,577.00	
						$40,176
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$724,460**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$108,669
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	3	Weeks	$2,875.00		$8,625
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$36,223
TOTAL						**$877,977**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site:530

Site Name: Piscataquag River Floodplain Goffstown, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	34	Acres	$10,000.00	$340,000.00	
						$340,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)		LS	$5,000.00	$0.00	
						$0
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00		
					$0.00	
Task 4. New Channel Shaping/Stream Restoration					$0.00	
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
					$0.00	$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)	1	LS	$10,000.00	$10,000.00	$10,000
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$450.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$350.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0.00
Subtotal Construction						**$350,000**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$52,500
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)		Weeks	$2,875.00		$0
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$17,500
TOTAL						**$420,000**

Notes:

1 - Construction estimate completed using 2008 dollars.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site:578

Site Name: Kimball Pond Road Bog Dunbarton, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
					$0.00	$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00		
					$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	16,754	SF	$1.80	$30,156.93	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$30,157
Task 8. Erosion and Sediment Control					$0.00	
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$0.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$0.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$35,157**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$5,274
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	1	Weeks	$2,875.00		$2,875
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$1,758
TOTAL						**$45,063**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site:666

Site Name: Turkey River Floodplain Concord, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)	94400	CY	$8.00	$755,200.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	94,400	CY	$10.00	$944,000.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	85,380	SF	$1.65	$140,877.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	236,500	SF	$1.70	$402,050.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)	100,000	SF	$0.70	$70,000.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)	100,000	SF	$0.20	$20,000.00	
						$632,927
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$28,481.72	$28,481.72	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$22,152.45	$22,152.45	
						$50,634
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$688,561**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$103,284
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	6	Weeks	$2,875.00		$17,250
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$34,428
TOTAL						**$843,523**

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Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site:671

Site Name: Turkey River Floodplain- White Farm Concord, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total	
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)			
	Permanent Easement		Acres	(per town)			
						$0	
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00		
						$5,000	
Task 3. Ditch Plugs							
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	37.5	CY	$100.00	$3,750.00		
						$3,750	
Task 4. New Channel Shaping/Stream Restoration							
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00		18000
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00		
						$0	
Task 5. Wetland Restoration							
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)	43,000	CY	$8.00	$344,000.00		0
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	61,000	CY	$10.00	$610,000.00		0
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00		
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00		
						$954,000	
Task 6. Invasive Species Removal/Soil Replacement							
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00		
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00		
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0	
Task 7. Plantings							
Aquatic Bed	Planting - General (NHDOT Item No. 650)	12,000	SF	$1.95	$23,400.00		
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00		
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	58,150	SF	$1.65	$95,947.50		
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	58,150	SF	$1.70	$98,855.00		1631
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00		
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00		12000
Seeding	Wetland Seed Mix (NHDOT Item 644)	100,000	SF	$0.70	$70,000.00		
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00		50
						$70,000	
Task 8. Erosion and Sediment Control							
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$42,930.00	$0.00		
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$33,390.00	$0.00		
						$0	
Task 9. Misc. Structures							
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00		
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00		
						$0	
Subtotal Construction						**$1,032,750**	
Task 9. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$154,913	
Task 10. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	4	Weeks	$2,875.00		$11,500	
Task 11.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$51,638	
TOTAL						**$1,250,800**	

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 672

Site Name:White Farm Concord, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total	
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)			
	Permanent Easement		Acres	(per town)			
						$0	
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00		
						$5,000	
Task 3. Ditch Plugs							
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)	37.5	CY	$100.00	$3,750.00		
						$3,750.00	
Task 4. New Channel Shaping/Stream Restoration							
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00		
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00		
						$0	
Task 5. Wetland Restoration							
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00		
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	100,000	SY	$1.00	$44,528.00		44,528
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00		
						$44,528	
Task 6. Invasive Species Removal/Soil Replacement							
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00		
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00		
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0	
Task 7. Plantings							
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00		
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00		
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	20,000	SF	$1.65	$7,812.39		4,735
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00		
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	20,000	SF	$1.80	$36,000.00		
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00		
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00		
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)	50,000	SF	$0.20	$10,000.00		50
						$36,000	
Task 8. Erosion and Sediment Control							
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$3,623.76	$3,623.76		
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$2,818.48	$2,818.48		
						$6,442	
Task 9. Misc. Structures							
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00		
Stormwater BMP - Small	Similar project (Webster Lake)	1	LS	$25,000.00	$25,000.00		
						$25,000	
Subtotal Construction						**$120,720**	
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$18,108	
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	2.5	Weeks	$2,875.00		$7,188	
Task 12 .Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$6,036	
TOTAL						**$152,052**	

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

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Six Bedford Farms Drive, Suite 607
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 689

Site Name: Burnham Brook Farmed Wetlands Epsom, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total	
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)			0
	Permanent Easement	1	Acres	$8,000.00	$8,000.00		0
						$8,000	
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00		
						$5,000	
Task 3. Ditch Plugs							
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00		
Task 4. New Channel Shaping/Stream Restoration							
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)	1,500	CY	$12.00	$18,000.00		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	1,500	CY	$10.00	$15,000.00		
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)	27,000	SY	$1.00	$27,000.00		
						$60,000	
Task 5. Wetland Restoration							
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00		
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00		
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00		
Task 6. Invasive Species Removal/Soil Replacement							
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00		
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00		
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0	
Task 7. Plantings							
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00		
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00		
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00		
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00		
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00		
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)	67,500	SF	$2.05	$138,375.00		3430
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00		
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00		
						$138,375	
Task 8. Erosion and Sediment Control							
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$2,700.00	$0.00		
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$2,100.00	$0.00		
						$0	
Task 9. Misc. Structures							
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00		
Stormwater BMP - Small	Similar project (Webster Lake)	2	LS	$25,000.00	$50,000.00		
						$50,000	
Subtotal Construction						**$261,375**	
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$39,206	
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	6	Weeks	$2,875.00		$17,250	
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$13,069	
TOTAL						**$330,900**	

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 704

Site Name: Bowen Brook Concord, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)	7,778	CY	$12.00	$93,333.33	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)	7,778	CY	$10.00	$77,777.78	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)	52,500	SY	$1.00	$52,500.00	
						$223,611
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	194,084	SY	$1.00	$194,084.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)	12,524	SF	$1.65	$20,663.78	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	174,676	SF	$1.65	$288,214.74	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	20,473	SF	$1.70	$34,804.44	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	30,492	SF	$1.80	$54,885.60	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)	83,309	SF	$2.05	$170,782.43	
Seeding	Wetland Seed Mix (NHDOT Item 644)	174,676	SF	$0.70	$122,272.92	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)	10,000	SF	$0.20	$2,000.00	
						$347,941
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$25,719.84	$25,719.84	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$20,004.32	$20,004.32	
						$45,724
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0.00
Subtotal Construction						**$622,276**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$93,341
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	12	Weeks	$2,875.00		$34,500
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$31,114
TOTAL						**$781,231**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 705

Site Name: State Prison Farm Concord, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total	
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)			
	Permanent Easement		Acres	(per town)			
						$0	
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00		
						$5,000	
Task 3. Ditch Plugs							
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00		
Task 4. New Channel Shaping/Stream Restoration							
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00		
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00		
						$0	
Task 5. Wetland Restoration							
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)	8,873	CY	$8.00	$70,986.67		
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00		
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	53,240	SY	$1.00	$53,240.00		440
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00		
						$124,227	
Task 6. Invasive Species Removal/Soil Replacement							
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00		
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00		
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00		
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0	
Task 7. Plantings							
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00		
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00		
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	59,895	SF	$1.65	$98,826.75		3960
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00		
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00		
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)	32,500	SF	$2.05	$66,625.00		200
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00		
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00		
						$165,452	
Task 8. Erosion and Sediment Control							
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$5,590.20	$5,590.20		
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$4,347.93	$4,347.93		
						$9,938	
Task 9. Misc. Structures							
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00		
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00		
						$0.00	
Subtotal Construction						**$304,617**	
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$45,692	
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	3	Weeks	$2,875.00		$8,625	
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$15,231	
TOTAL						**$374,165**	

Notes:
1 - Construction estimate completed using 2008 dollars.
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site:733

Site Name: Gulf Brook Headwaters Pittsfield, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	12	Acres	$8,000.00	$96,000.00	
						$96,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)		LS	$5,000.00	$0.00	
						$0
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	29,621	SF	$1.80	$53,317.44	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$53,317
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$0.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$0.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$149,317**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$22,398
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	1	Weeks	$2,875.00		$2,875
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$7,466
TOTAL						**$182,056**

Notes:

1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site:769

Site Name: Hunting Swamp Headwaters, Loudon, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement		Acres	(per town)		
						$0
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)		LS	$5,000.00	$0.00	
						$0
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	19,360	SY	$1.00	$19,360.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$19,360
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	
						$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	15,246	SF	$1.65	$25,155.90	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	13,794	SF	$1.70	$23,449.80	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$48,606
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)	1	LS	$871.20	$871.20	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)	1	LS	$677.60	$677.60	
						$1,549
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)	2	LS	$25,000.00	$50,000.00	
						$50,000
Subtotal Construction						**$119,515**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$17,927
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	2	Weeks	$2,875.00		$5,750
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$5,976
TOTAL						**$149,167**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

Vanasse Hangen Brustlin, Inc.
Six Bedford Farms Drive, Suite 607
Bedford, New Hampshire 03110

Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 800/804

Site Name: Sod Farms, West Road Canterbury, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	20	Acres	$12,000.00	$240,000.00	
						$240,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)	1,852	CY	$12.00	$22,222.22	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)	2,778	SY	$1.00	$2,777.78	
						$25,000
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)	18,679	SY	$1.00	$18,679.11	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
						$18,679
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)	86,031	SF	$1.70	$146,252.70	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	150,000	SF	$1.80	$270,000.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)	25,000	SF	$2.05	$51,250.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)	50,000	SF	$0.70	$35,000.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)	10,000	SF	$0.20	$2,000.00	
						$356,250
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$1,965.56	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$1,528.77	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0
Subtotal Construction						**$644,929**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$96,739
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	2	Weeks	$2,875.00		$5,750
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$32,246
TOTAL						**$779,665**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.
4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 806

Site Name: Tannery Brook Boscawen, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	10	Acres	$12,000.00	$120,000.00	
						$120,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Remove and Stockpile Existing Vegetation & Soils						
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)	10,164	CY	$8.00	$81,312.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29	10,164	CY	$20.00	$203,280.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
						$284,592
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)	8,276	SF	$1.95	$16,138.98	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)	30,492	SF	$1.65	$50,311.80	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	4,356	SF	$1.80	$7,840.80	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)	14,520	SF	$2.05	$29,766.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$104,058
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$12,806.64	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$9,960.72	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0.00
Subtotal Construction						**$513,650**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$77,047
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)		Weeks	$2,875.00		$0
Task 12. Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$25,682
TOTAL					$0	**$616,379**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 825/826

Site Name: Kelly Brook Trib. Headwaters Loudon, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	8.05	Acres	$8,000.00	$64,400.00	
						$64,400
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)	1	LS	$5,000.00	$5,000.00	
						$5,000
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$100.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings						
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)	49,368	SF	$1.80	$88,862.40	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$88,862
Task 8. Erosion and Sediment Control					$0.00	
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$0.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$0.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)	1	LS	$25,000.00	$25,000.00	
						$25,000.00
Subtotal Construction						**$183,262**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	15%		$27,489
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)	1	Weeks	$2,875.00		$2,875
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$9,163
TOTAL						**$222,790**

Notes:
1 - Construction estimate completed using 2008 dollars.
2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*
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Merrimack River Watershed Wetland Restoration Strategy
Restoration Site - Conceptual Cost Estimate

Candidate Site: 1010

Site Name: Lower Shields Pond Derry, NH

Scope Item	Description & Reference	Quantity	Unit	Unit Price	Extension	Task Total
Task 1. Construction & Permanent Easements	Construction Easement		Acres	(per town)		
	Permanent Easement	115	Acres	$6,000.00	$690,000.00	
						$690,000
Task 2. Mobilization and Demobilization	Contractor Startup (NHDOT Item No. 692)		LS	$5,000.00	$0.00	
						$0
Task 3. Ditch Plugs						
Install In-channel Ditch Plugs	Fill material, @ 7.5 yds per plug (NHDOT Item No. 203.52)		CY	$10.00	$0.00	
Task 4. New Channel Shaping/Stream Restoration						
Reshape Low Flow Channel	Channel Excavation (NHDOT Item No. 207.3)		CY	$12.00	$0.00	
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Channel & Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
						$0
Task 5. Wetland Restoration						
Strip Topsoil	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Remove and Stockpile Existing Vegetation & Soils						
Rough Grading	Common Excavation (NHDOT Item No. 203.1)		CY	$10.00	$0.00	
Fine Grade Wetland	Fine Grading (NHDOT Item No. 214)		SY	$1.00	$0.00	
Replace Topsoil	Wetland Humus (NHDOT Item No. 647.29)		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1)		CY	$11.95	$0.00	
Task 6. Invasive Species Removal/Soil Replacement						
Remove Invasive plants	Wetland Soil Excavation (NHDOT Item No. 203.49)		CY	$8.00	$0.00	
Replace with new wetland soil	Wetland Humus (NHDOT Item No. 647.29		CY	$20.00	$0.00	
Additional Topsoil	Humus (NHDOT Item No. 647.1		CY	$11.95	$0.00	
Galerucella beetle treatment	D. Cygan (NH Dept. of Agriculture)		LS	$10,000.00	$0.00	$0
Task 7. Plantings					$0.00	
Aquatic Bed	Planting - General (NHDOT Item No. 650)		SF	$1.95	$0.00	
Emergent - Deep Marsh	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Emergent - Wet Meadow	Planting - General (NHDOT Item No. 650)		SF	$1.65	$0.00	
Scrub/Shrub	Planting - General (NHDOT Item No. 650)		SF	$1.70	$0.00	
Forested/Floodplain Wetland or Forested Upland	Planting - General (NHDOT Item No. 650)		SF	$1.80	$0.00	
River Bank/Riparian Zone	Planting - General (NHDOT Item No. 650)		SF	$2.05	$0.00	
Seeding	Wetland Seed Mix (NHDOT Item 644)		SF	$0.70	$0.00	
Upland Seeding	Conservation Seed Mix (NHDOT Item 644)		SF	$0.20	$0.00	
						$0
Task 8. Erosion and Sediment Control						
Sediment Control	Miscellaneous Permanent and Temporary Erosion Controls (NHDOT Item No. 645)		LS	$0.00	$0.00	
Water Control Structures	Install Cofferdams During Construction (NHDOT Item No. 503)		LS	$0.00	$0.00	
						$0
Task 9. Misc. Structures						
Culvert Replacement - Small	Similar project (VTrans)		LS	$10,000.00	$0.00	
Stormwater BMP - Small	Similar project (Webster Lake)		LS	$25,000.00	$0.00	
						$0.00
Subtotal Construction						**$690,000**
Task 10. Design & Permitting	Consultant Fees for Final Survey, Geotechnical Investigations, Design, and Permitting, Complex		Contract	25%		$103,500
Task 11. Construction Observation	Field Engineer PM, Average (RS Means No. 01 31 13.20 0180)		Weeks	$2,875.00		$0
Task 12.Long-term Monitoring/NHDES Report Preparation	Oversight and Management of the Project, Low Range (RS Means No. 01 11 31.20 0020)		Project	5%		$34,500
TOTAL						**$828,000**

Notes:

1 - Construction estimate completed using 2008 dollars.

2 - NHDOT Item Numbers are from the publication, *NHDOT Standard Specifications - 2006 Edition.*

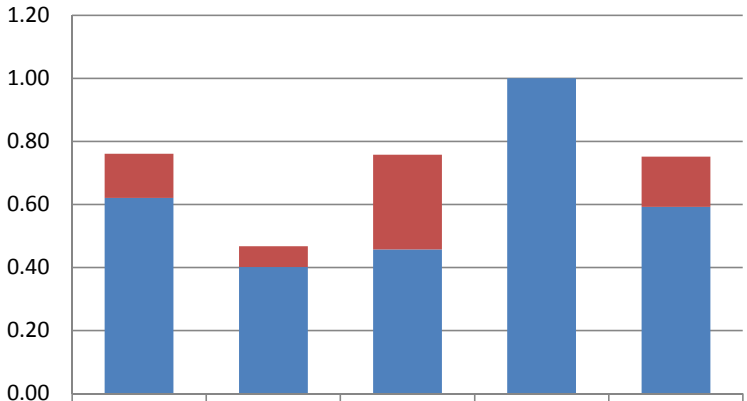
3 - NHDOT Item Costs are taken from NHDOT Weighted Average Unit Prices Years 2008 Qtrs 3,2,1 and 2007 Qtr 4, accessed via the internet.

4 - RS Means Item Numbers and Costs are taken from the publication, *Site Work & Landscape Cost Data, 27th Annual Edition, 2008.*

Appendix F

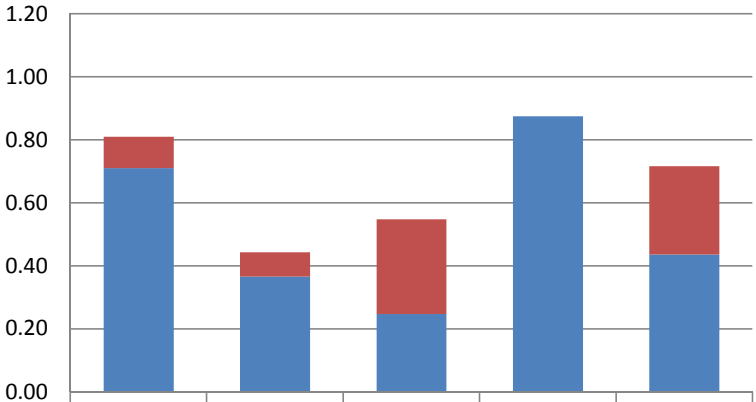
Functional Benefit Scores for Example Sites

Site #5, Jericho Road



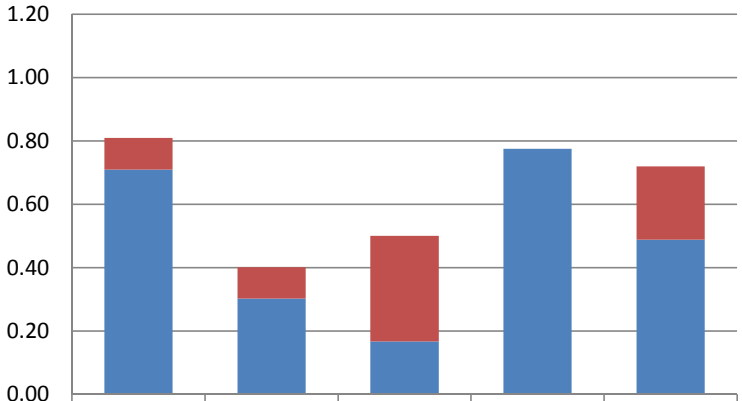
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.14	0.07	0.30	0.00	0.16
Existing Functional Index	0.62	0.40	0.46	1.00	0.59

Site #6, Beaver Brook Tributary



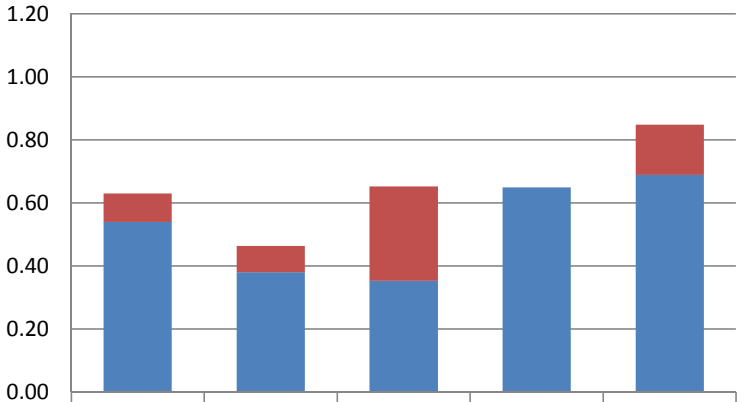
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.10	0.08	0.30	0.00	0.28
Existing Functional Index	0.71	0.37	0.25	0.88	0.44

Site # 76, Tributary to Harris Brook



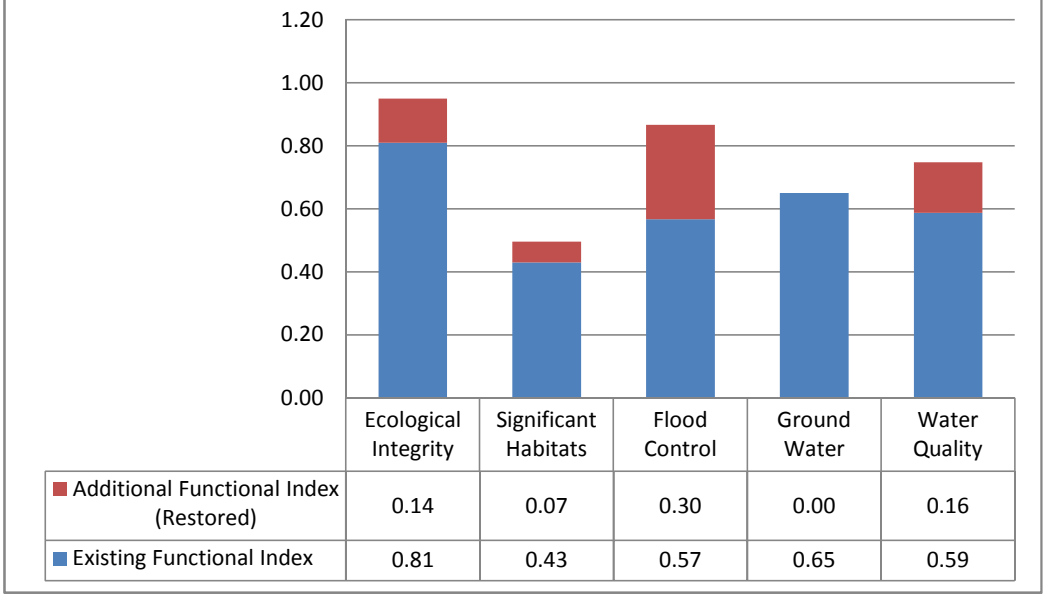
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.10	0.10	0.33	0.00	0.23
Existing Functional Index	0.71	0.30	0.17	0.78	0.49

Site #71, Salmon Brook



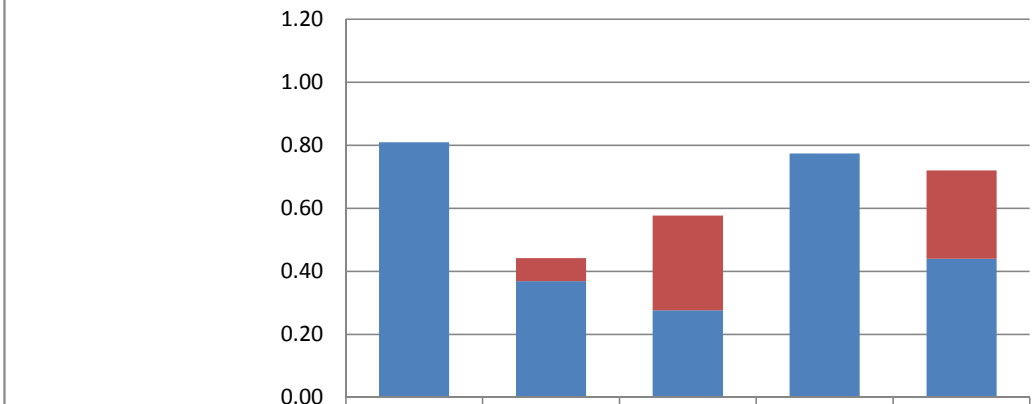
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.09	0.08	0.30	0.00	0.16
Existing Functional Index	0.54	0.38	0.35	0.65	0.69

Site #52, Musquash Brook Headwaters

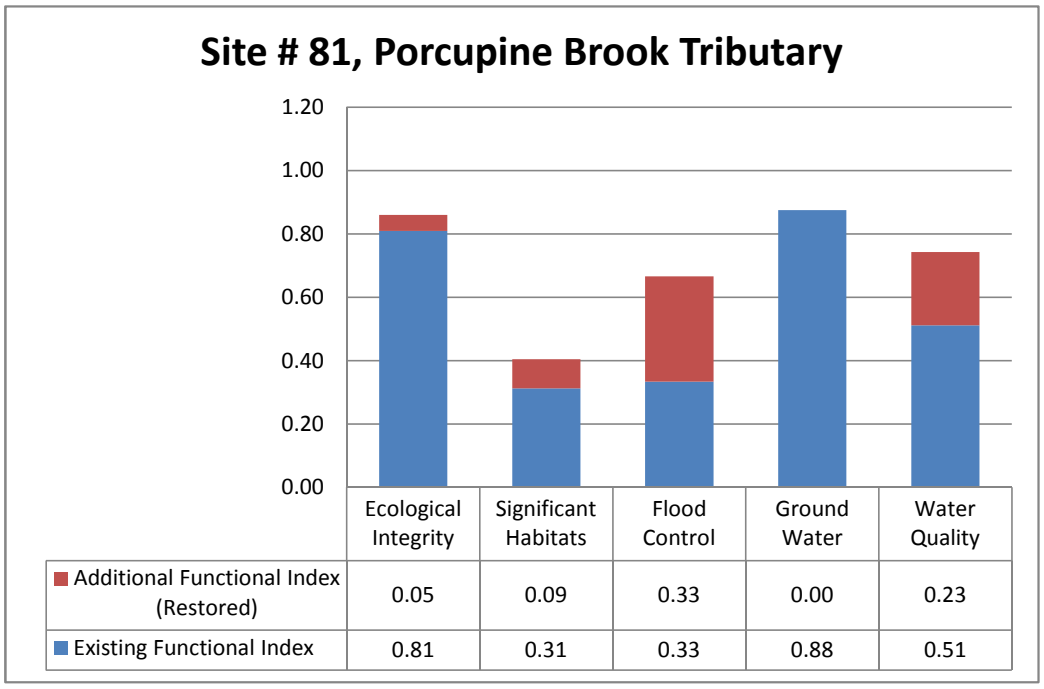


	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.14	0.07	0.30	0.00	0.16
Existing Functional Index	0.81	0.43	0.57	0.65	0.59

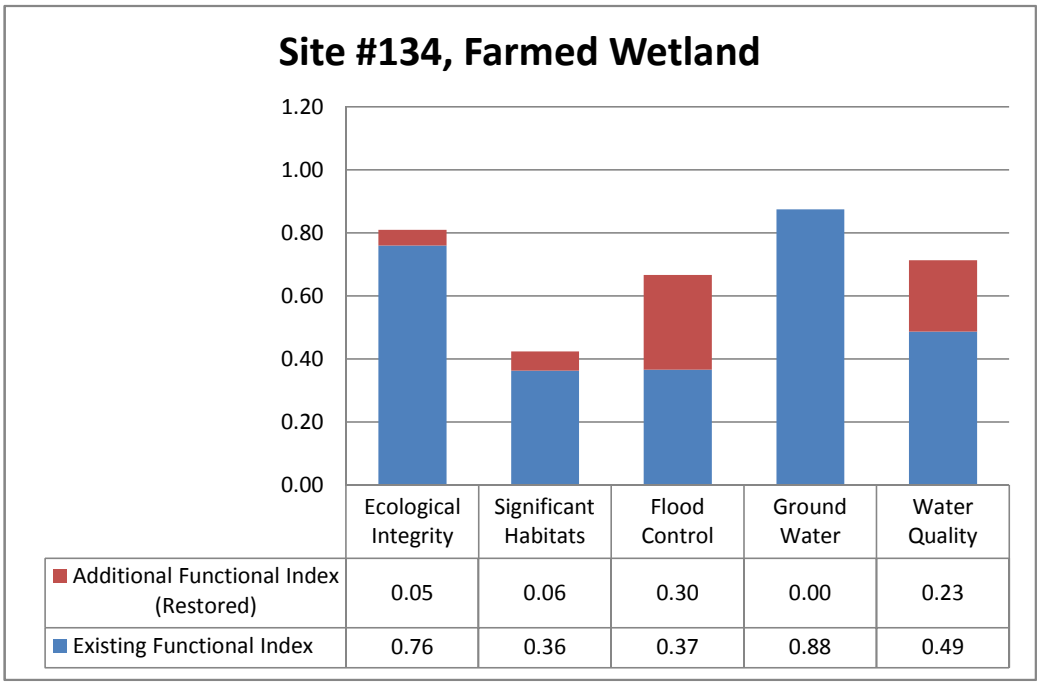
Site #67, Second Brook Swamp



	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.00	0.07	0.30	0.00	0.28
Existing Functional Index	0.81	0.37	0.28	0.78	0.44

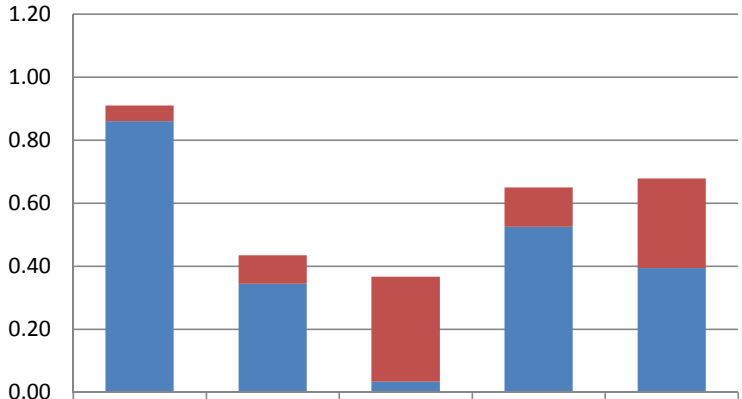


	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.09	0.33	0.00	0.23
Existing Functional Index	0.81	0.31	0.33	0.88	0.51



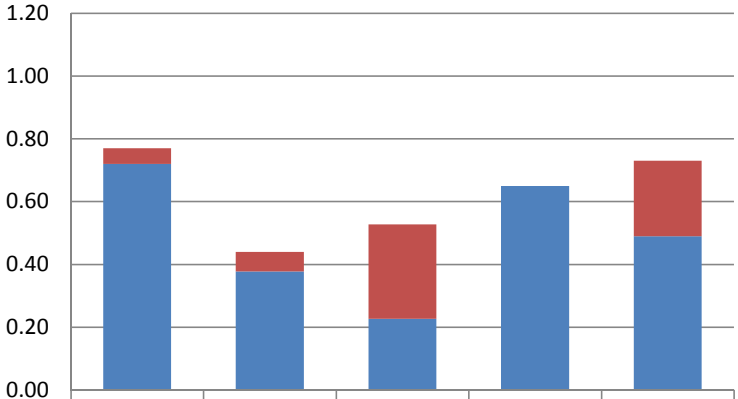
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.06	0.30	0.00	0.23
Existing Functional Index	0.76	0.36	0.37	0.88	0.49

Site # 218, Nesenkeag Brook Headwaters

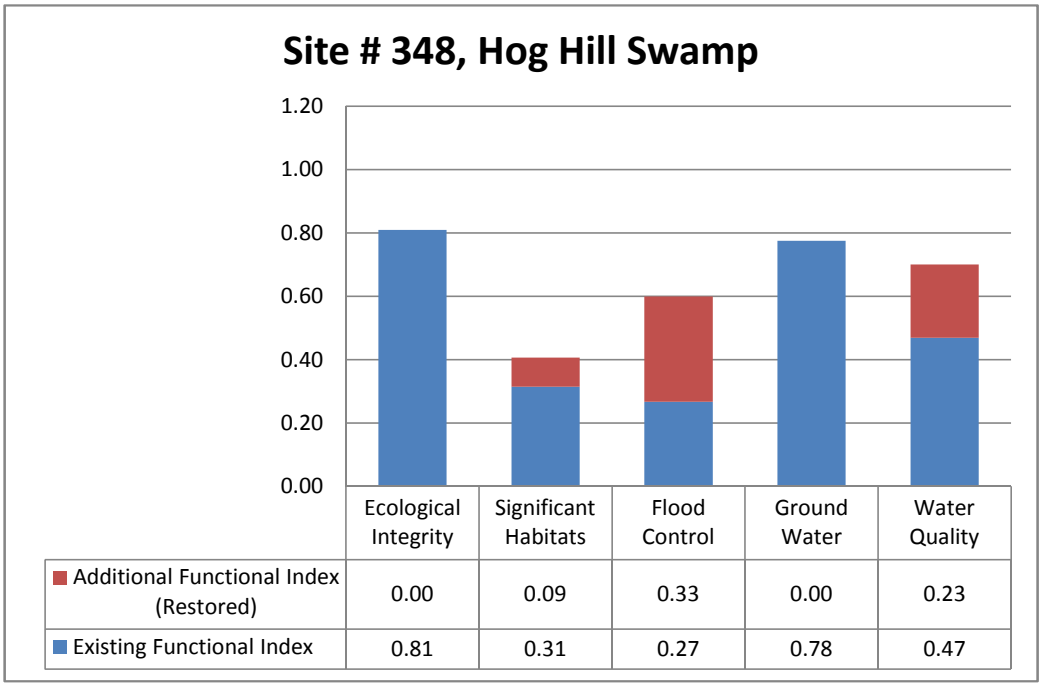


	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.09	0.33	0.13	0.28
Existing Functional Index	0.86	0.34	0.03	0.53	0.39

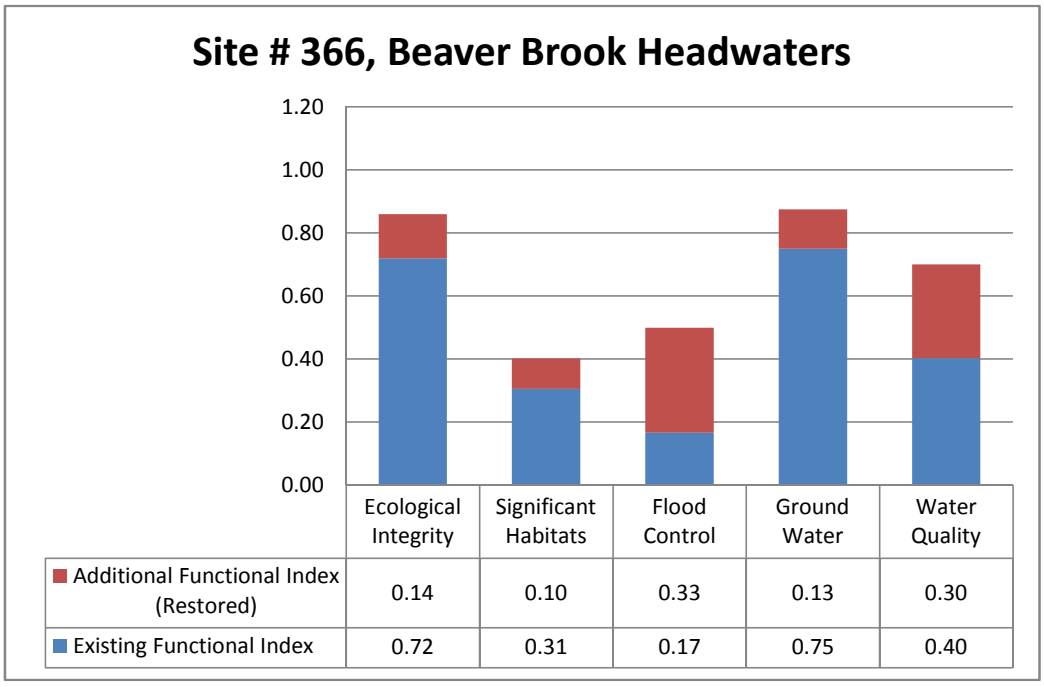
ID #231, Hartshorn Brook, Joslin Road



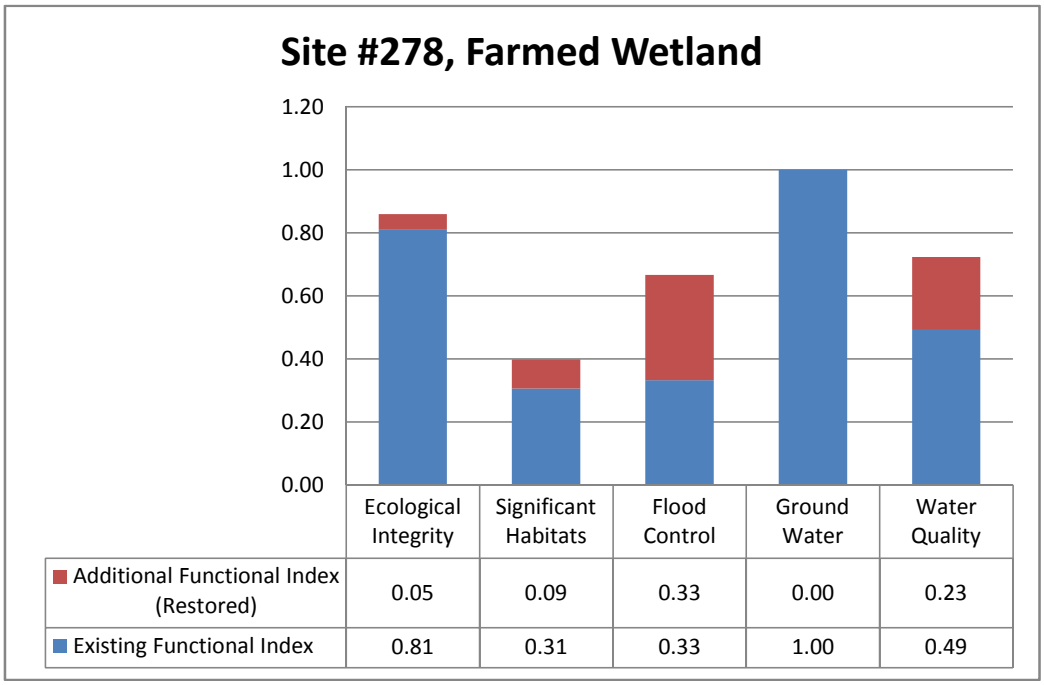
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.06	0.30	0.00	0.24
Existing Functional Index	0.72	0.38	0.23	0.65	0.49



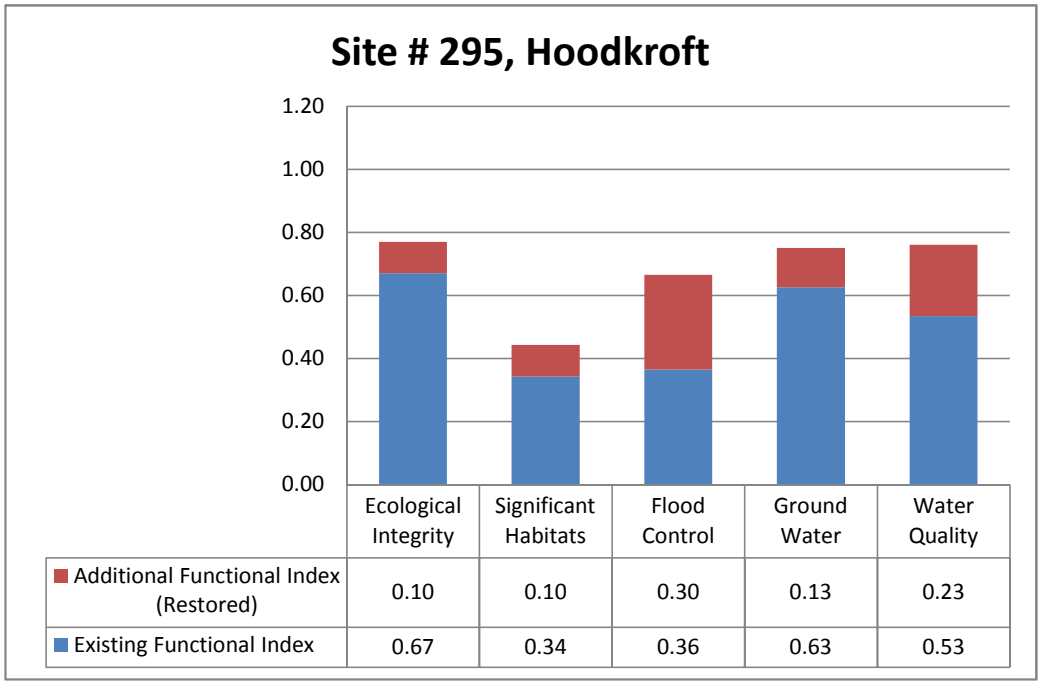
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.00	0.09	0.33	0.00	0.23
Existing Functional Index	0.81	0.31	0.27	0.78	0.47



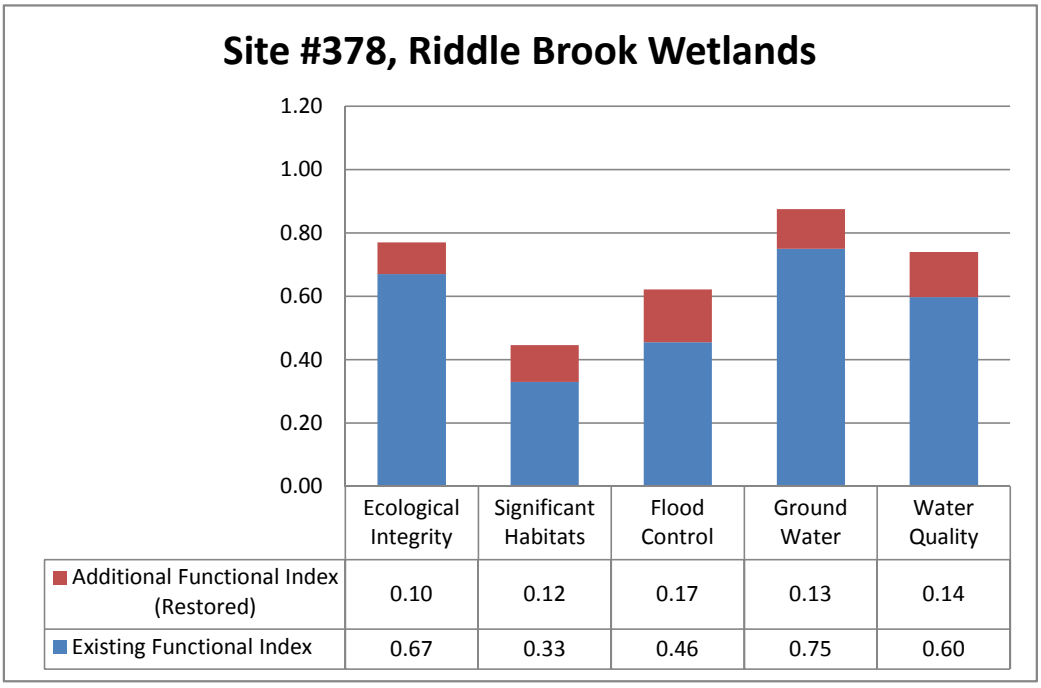
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.14	0.10	0.33	0.13	0.30
Existing Functional Index	0.72	0.31	0.17	0.75	0.40



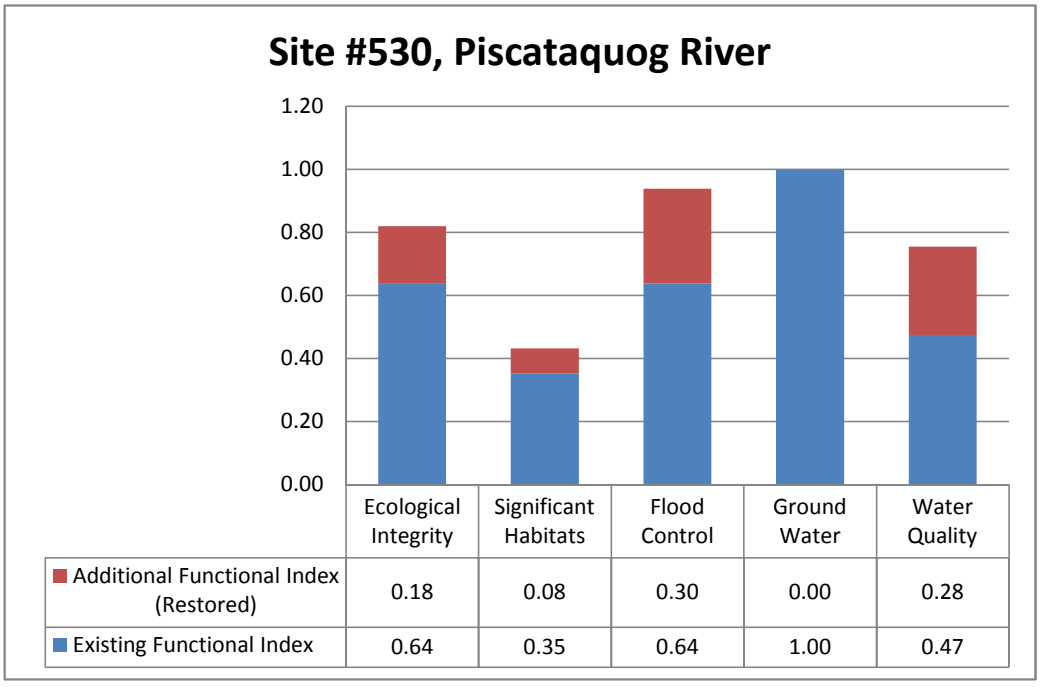
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.09	0.33	0.00	0.23
Existing Functional Index	0.81	0.31	0.33	1.00	0.49



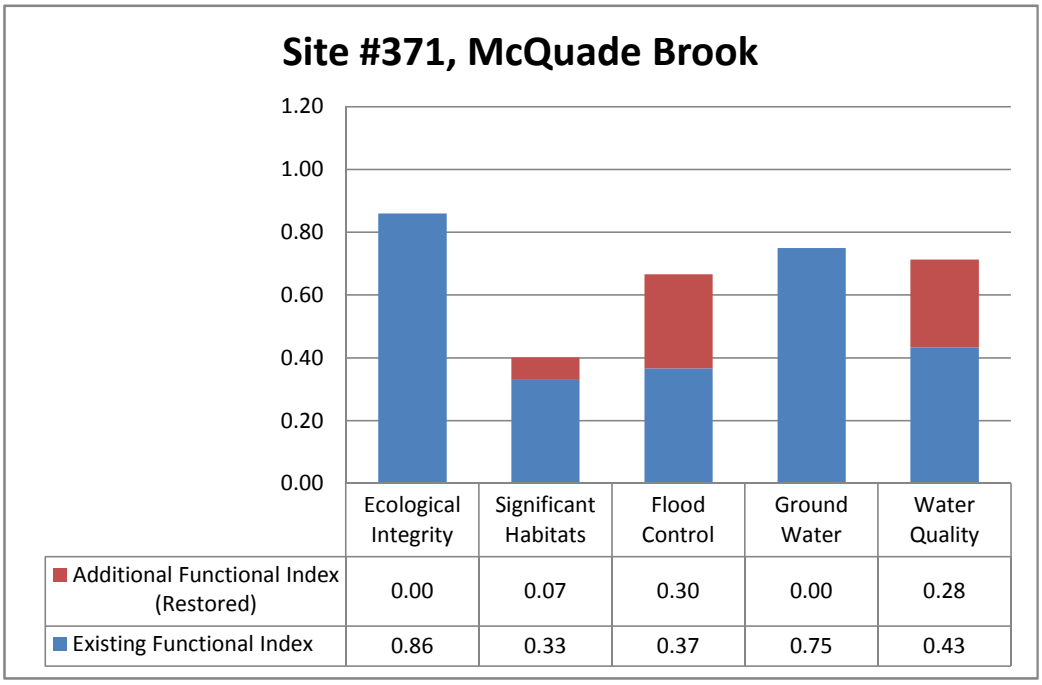
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.10	0.10	0.30	0.13	0.23
Existing Functional Index	0.67	0.34	0.36	0.63	0.53



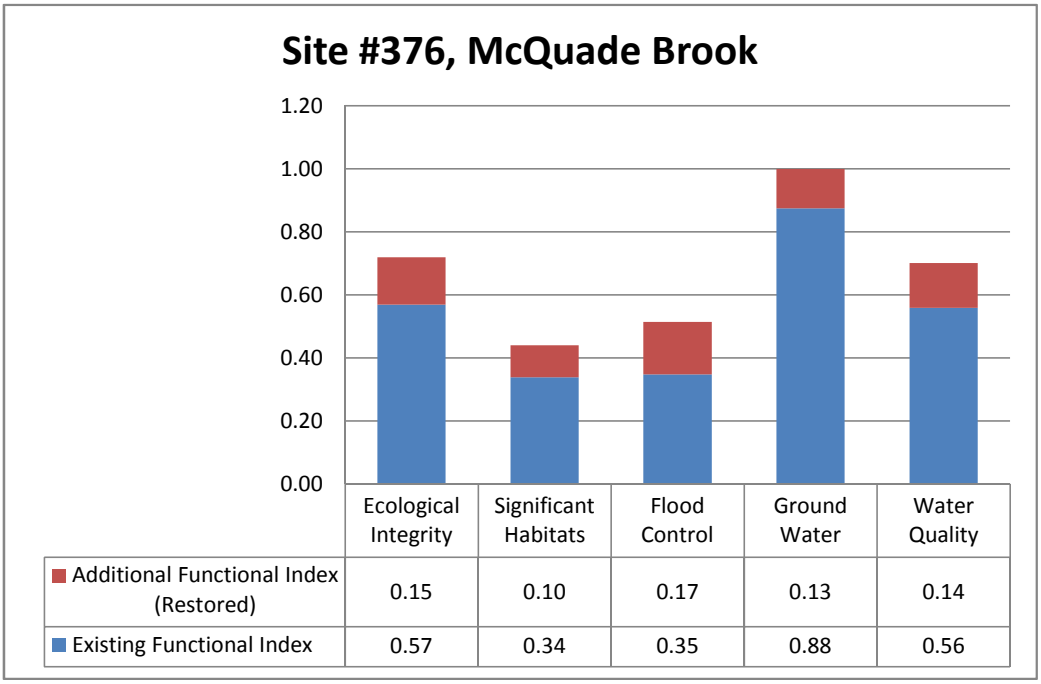
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.10	0.12	0.17	0.13	0.14
Existing Functional Index	0.67	0.33	0.46	0.75	0.60



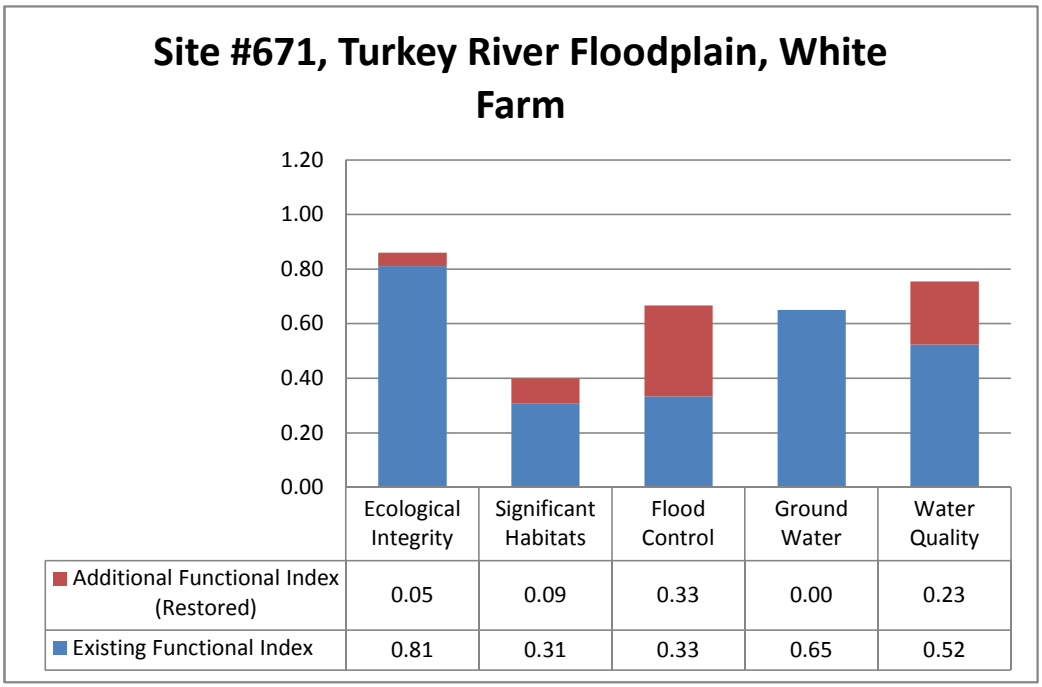
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.18	0.08	0.30	0.00	0.28
Existing Functional Index	0.64	0.35	0.64	1.00	0.47



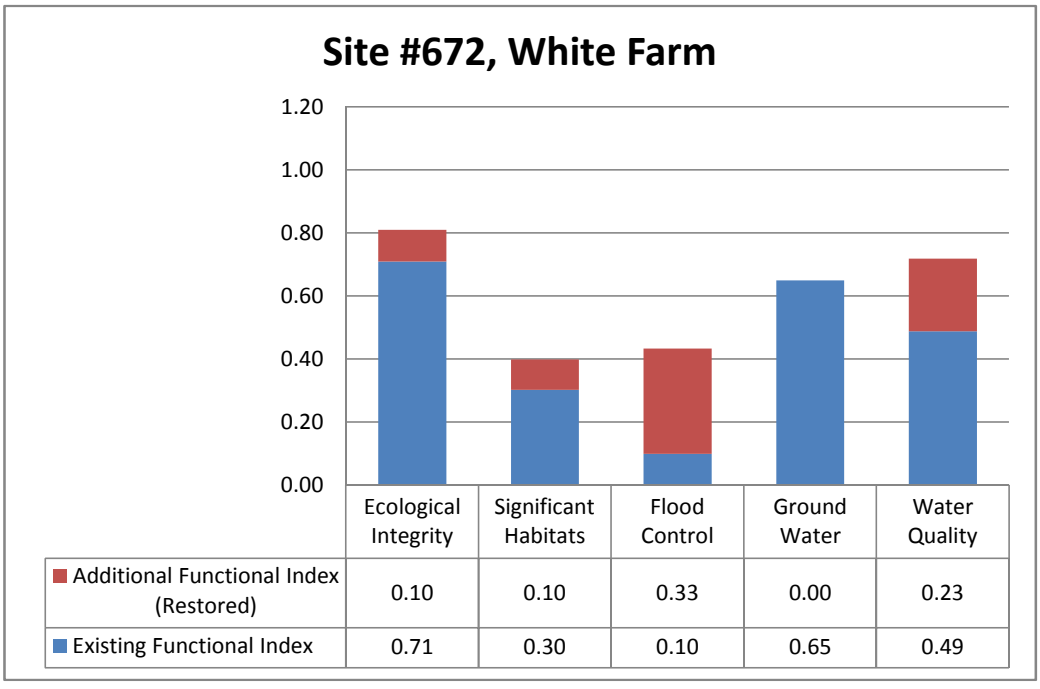
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.00	0.07	0.30	0.00	0.28
Existing Functional Index	0.86	0.33	0.37	0.75	0.43



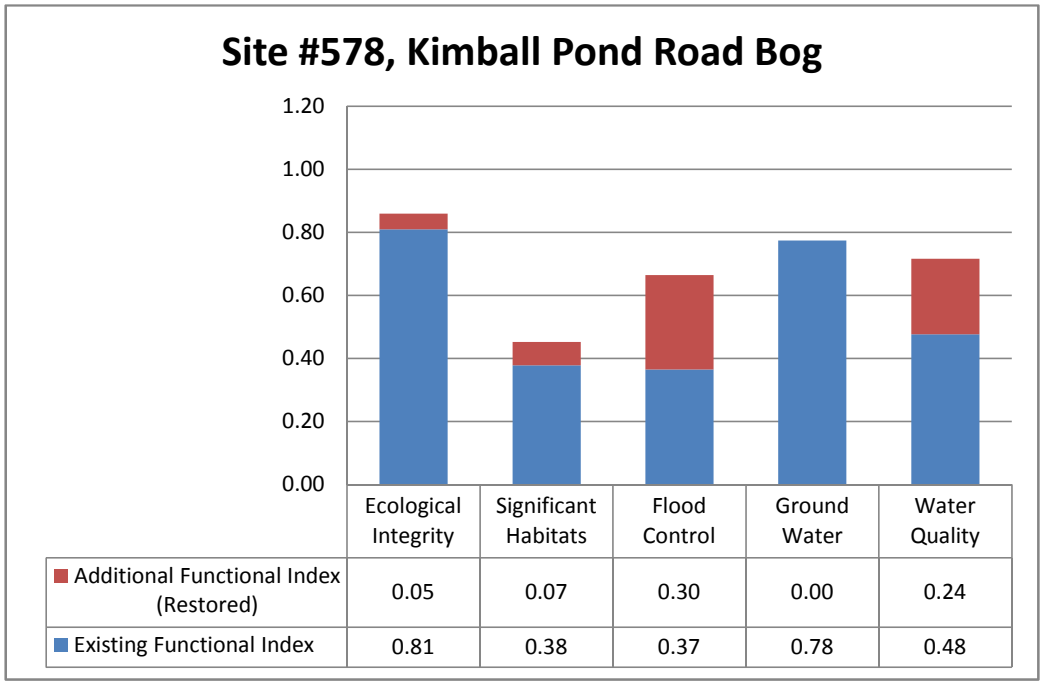
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.15	0.10	0.17	0.13	0.14
Existing Functional Index	0.57	0.34	0.35	0.88	0.56



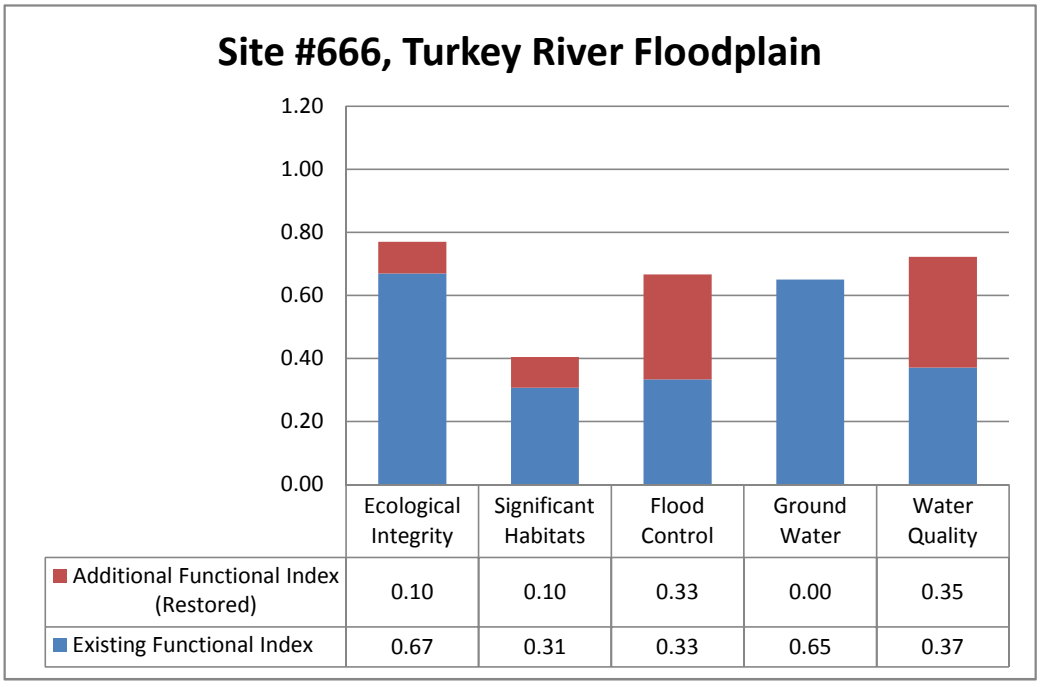
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.09	0.33	0.00	0.23
Existing Functional Index	0.81	0.31	0.33	0.65	0.52



	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.10	0.10	0.33	0.00	0.23
Existing Functional Index	0.71	0.30	0.10	0.65	0.49

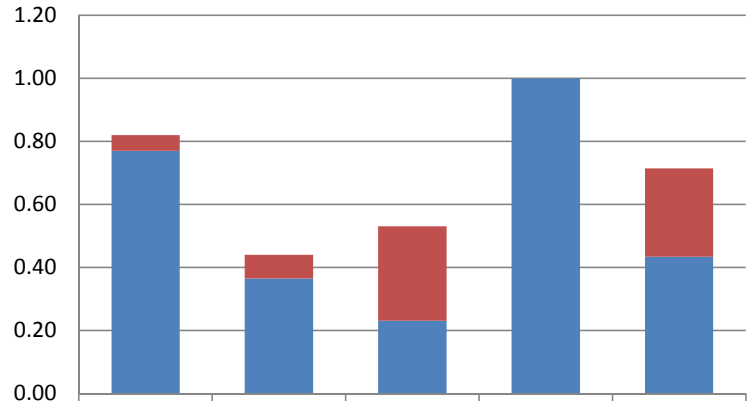


	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.07	0.30	0.00	0.24
Existing Functional Index	0.81	0.38	0.37	0.78	0.48



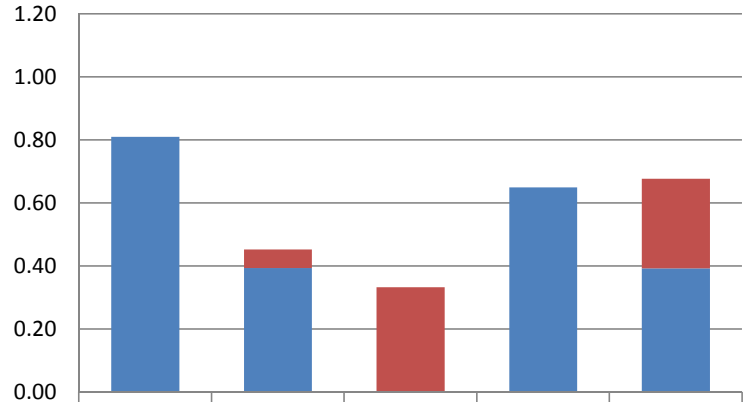
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.10	0.10	0.33	0.00	0.35
Existing Functional Index	0.67	0.31	0.33	0.65	0.37

Site #689, Burnham Brook Farmed Wetlands

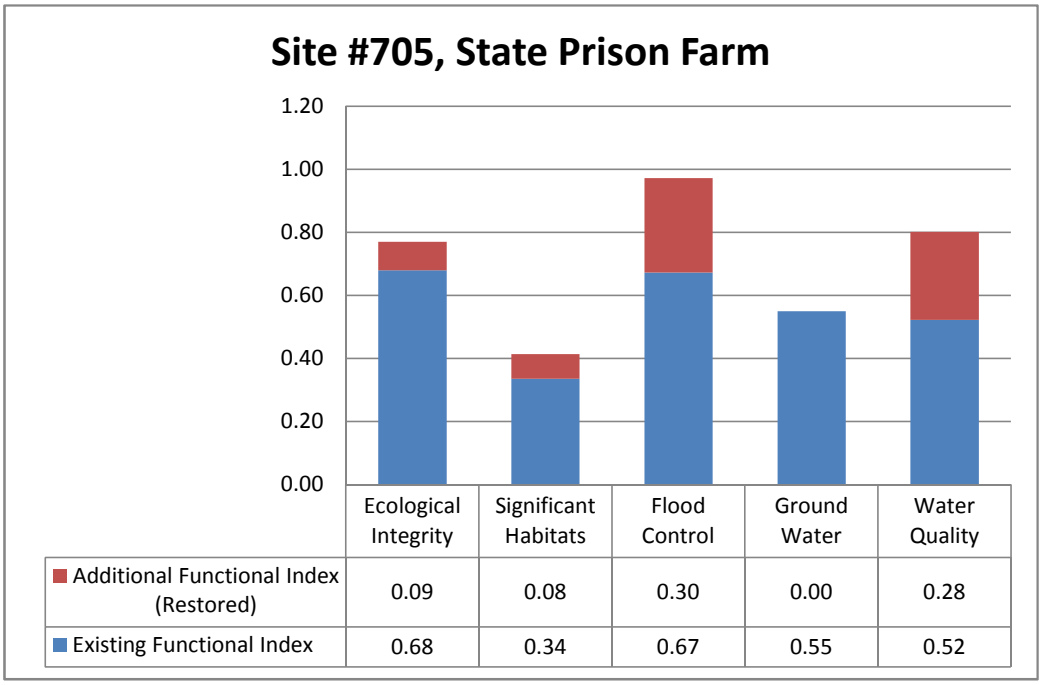


	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.08	0.30	0.00	0.28
Existing Functional Index	0.77	0.37	0.23	1.00	0.43

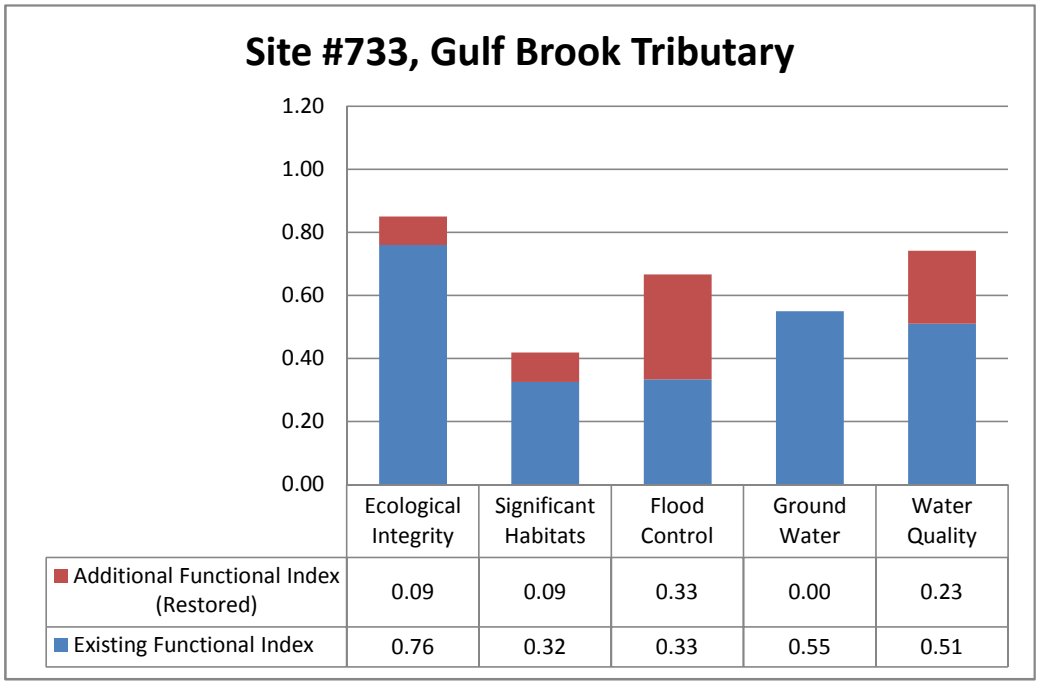
Site#704, Bowen Brook



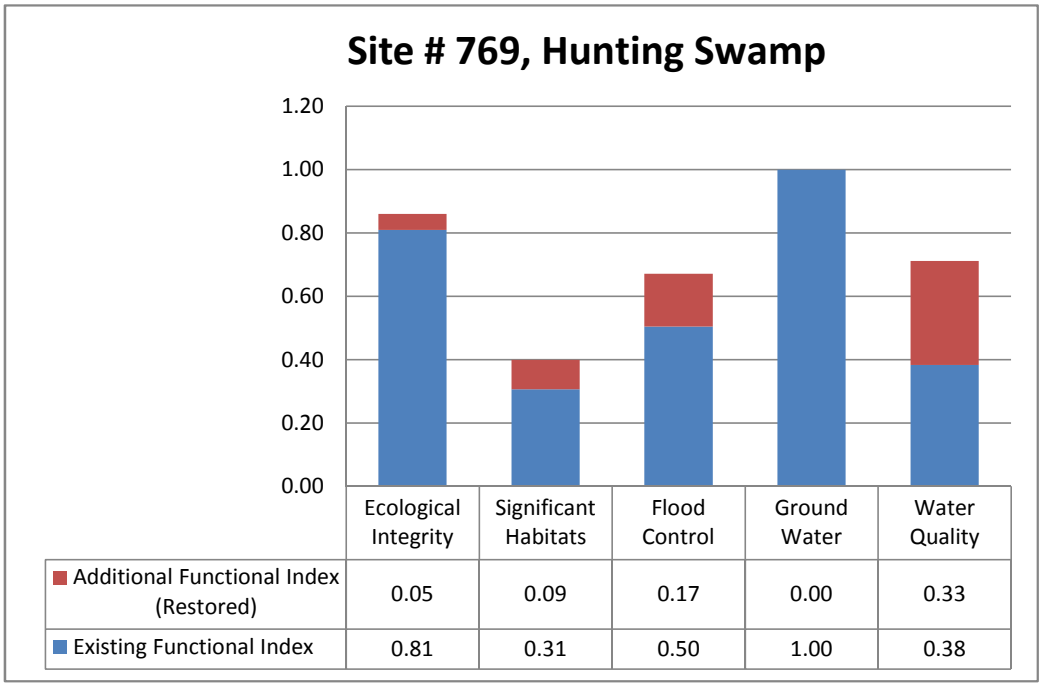
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.00	0.06	0.33	0.00	0.28
Existing Functional Index	0.81	0.39	0.00	0.65	0.39



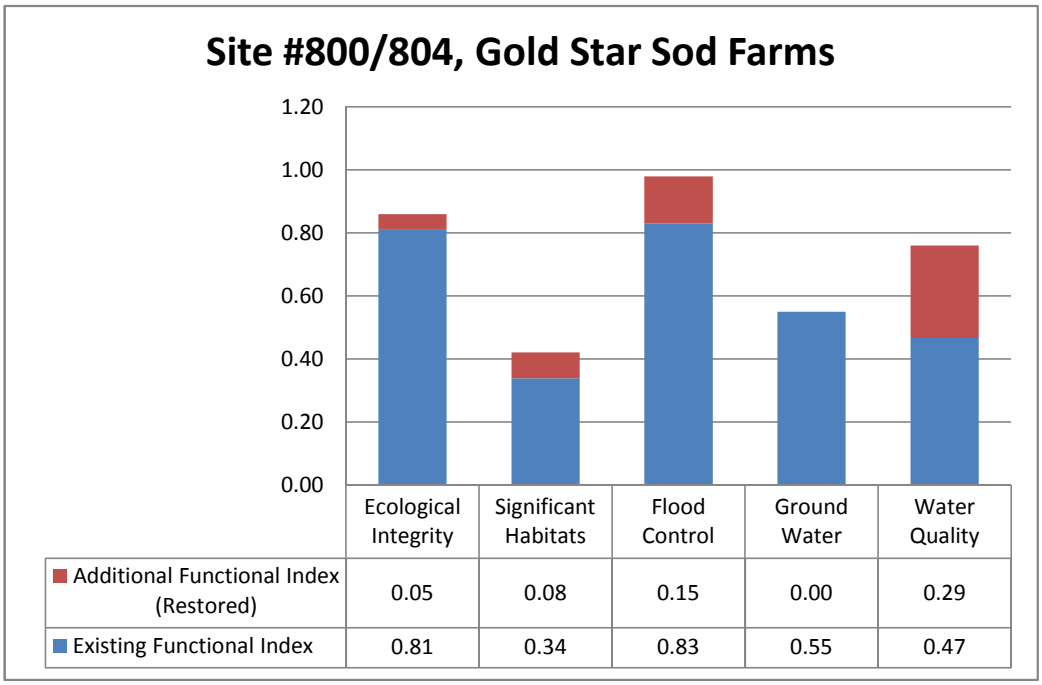
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.09	0.08	0.30	0.00	0.28
Existing Functional Index	0.68	0.34	0.67	0.55	0.52



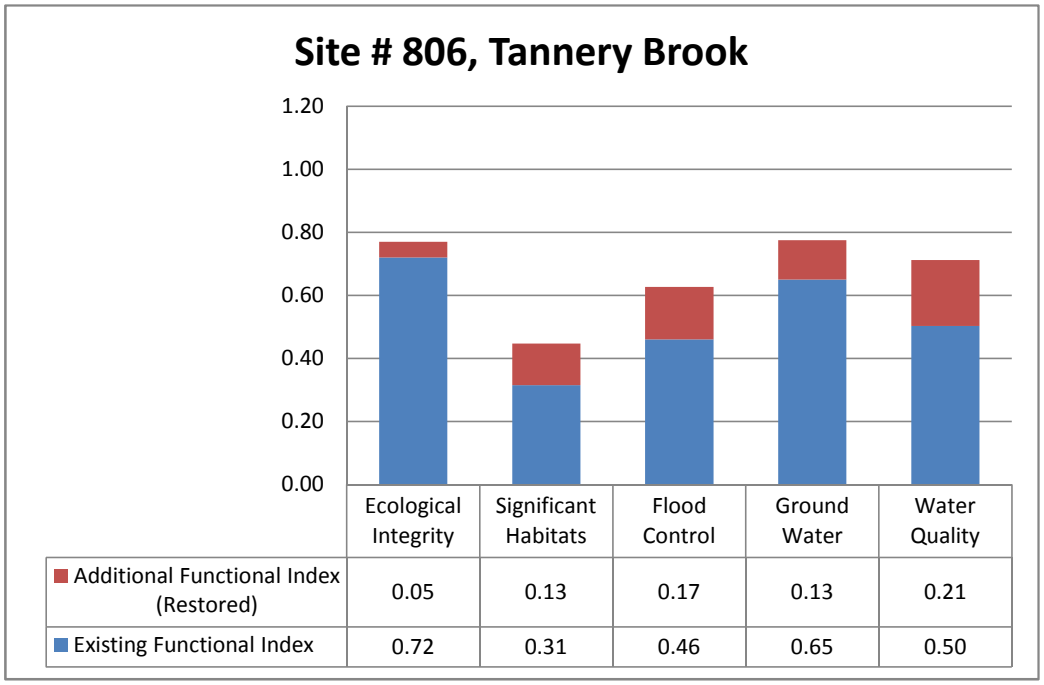
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.09	0.09	0.33	0.00	0.23
Existing Functional Index	0.76	0.32	0.33	0.55	0.51



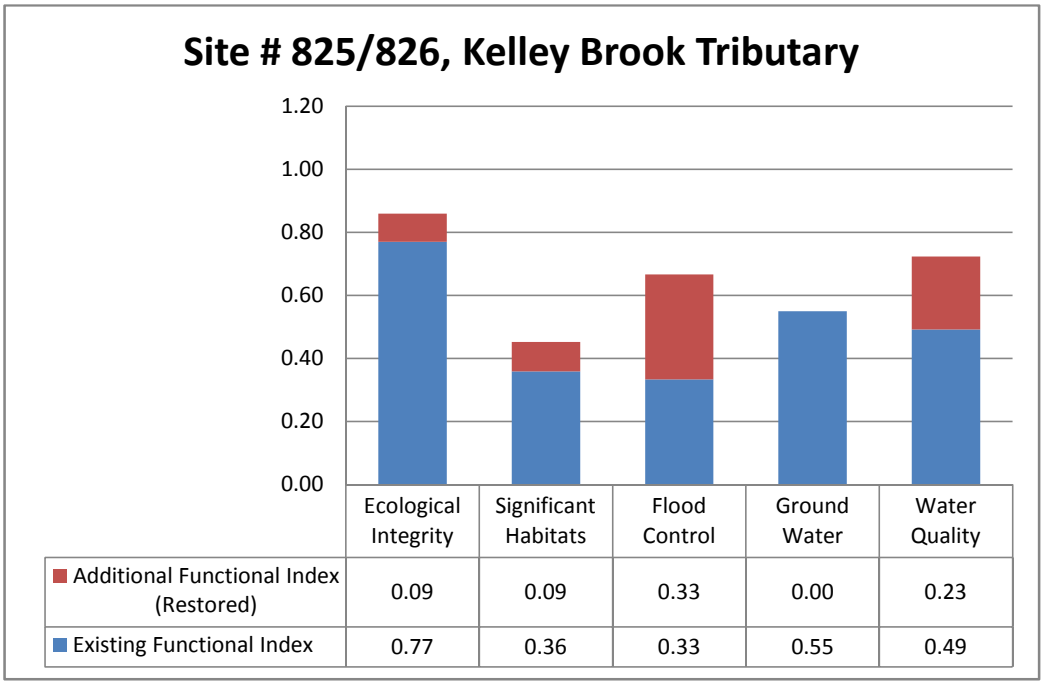
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.09	0.17	0.00	0.33
Existing Functional Index	0.81	0.31	0.50	1.00	0.38



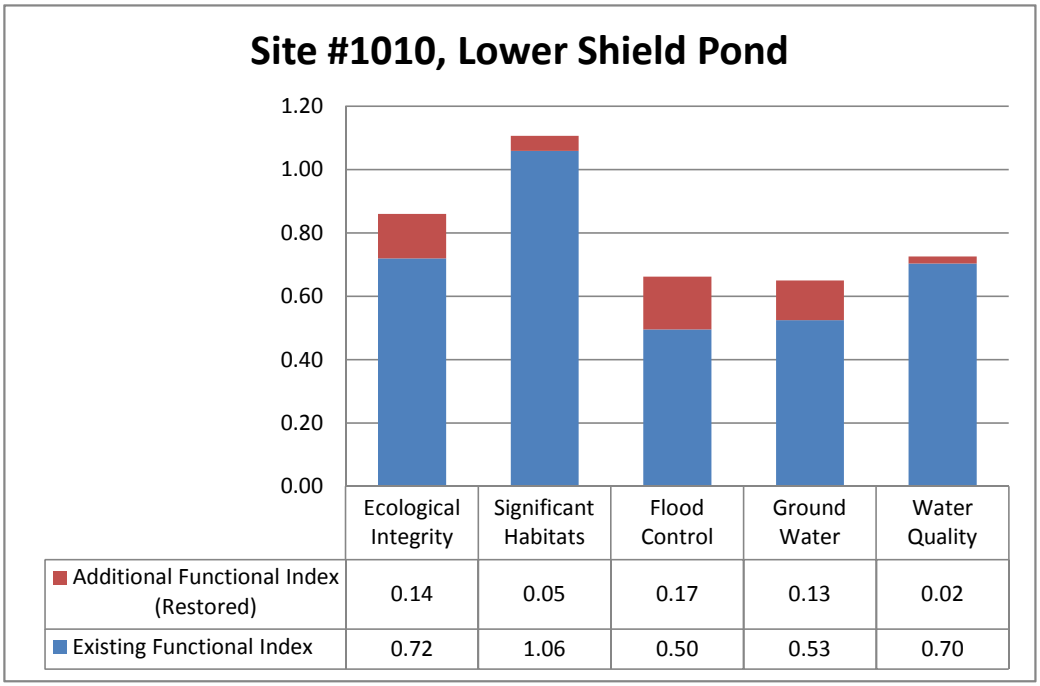
	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.08	0.15	0.00	0.29
Existing Functional Index	0.81	0.34	0.83	0.55	0.47



	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.05	0.13	0.17	0.13	0.21
Existing Functional Index	0.72	0.31	0.46	0.65	0.50



	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.09	0.09	0.33	0.00	0.23
Existing Functional Index	0.77	0.36	0.33	0.55	0.49



	Ecological Integrity	Significant Habitats	Flood Control	Ground Water	Water Quality
Additional Functional Index (Restored)	0.14	0.05	0.17	0.13	0.02
Existing Functional Index	0.72	1.06	0.50	0.53	0.70