

Town of Goffstown Prime Wetlands Study & Mapping

Submitted to

Town of Goffstown
Board of Selectmen & Conservation Commission

Submitted by

Vanasse Hangen Brustlin, Inc.
Bedford, New Hampshire



T e c h n i c a l R e p o r t



Gorham Brook and its associated wetlands, Goffstown, NH

Prime Wetlands Study

Goffstown
New Hampshire

Prepared for **Board of Selectmen & Conservation Commission**
Goffstown, New Hampshire

Prepared by ***VHB*/Vanasse Hangen Brustlin, Inc.**
Bedford, New Hampshire

December 2004

Table of Contents

Table of Contents	i
List of Tables	iii
List of Figures	iv
Introduction	1
Environmental Setting	2
Methodology	5
3.1 Existing Information Retrieval and Base Map Development.....	5
3.2 Field Investigations and Mapping	6
3.3 Functions and Value Assessment.....	7
Candidate Prime Wetlands	9
4.1 Gorham Brook Wetlands.....	9
4.2 Gorham Brook Tributary and Associated Wetlands.....	11
4.3 Saunders Road Wetlands.....	12
4.4 Snook Road Swamp	14
4.5 Beaver Pond/Harry Brook Tributary Marsh.....	15
4.6 Upper Harry Brook Associated Wetlands	17
4.7 Middle Harry Brook and Associated Wetlands.....	19
4.8 Paige Hill Road Marsh	24
4.9 Stinson Road Marsh	26
4.10 Upper Black Brook (Northern Portion)	28
4.11 Upper Black Brook (Southern Portion).....	29
4.12 Lower Black Brook Marsh	31
4.13 Lower Harry Brook at Locust Hill Road.....	32
4.14 Piscataquog River Floodplain	34
4.15 Uncanoonuc Marsh.....	35
4.16 Shirley Hill Road Wetlands	37
4.17 Perennial Tributary to Piscataquog and Associated Wetlands	39
4.18 Paige Hill Swamp.....	40
4.19 Juniper Drive Wetlands.....	42
4.20 Bog Brook Tributary	43
4.21 Hardy Brook Headwaters.....	44
Discussion and Summary	46
5.1 Comparisons of Functional Value	46
5.2 Comparisons Among Wetlands	51

Literature Cited 52

Appendices

Appendix A – Wetland Photographs

Appendix B – Wetland Orthophoto Mapping

Appendix C – Summary Data Tables & Figures

Appendix D – Prime Wetland Maps (under separate cover)

Table No.	Description	Page
4-1	Gorham Brook Wetland.....	10
4-2	Gorham Brook Tributary & Associated Wetlands.....	12
4-3	Saunders Road Wetland.....	13
4-4	Snook Road Swamp	15
4-5	Beaver Pond/ Harry Brook Tributary Marsh.....	16
4-6	Upper Harry Brook & Northern Associated Wetlands	18
4-7	Upper Harry Brook & Southern Associated Wetlands.....	19
4-8	Middle Harry Brook & Northern Associated Wetlands	21
4-9	Middle Harry Brook & Central Associated Wetlands.....	22
4-10	Middle Harry Brook & Southern Associated Wetlands.....	23
4-11	Paige Hill Road Marsh	26
4-12	Stinson Road Marsh.....	27
4-13	Upper Black Brook (Northern Portion)	29
4-14	Upper Black Brook (Southern Portion).....	30
4-15	Lower Black Brook Marsh	32
4-16	Lower Harry Brook at Locust Hill Road.....	33
4-17	Piscataquog River Floodplain	34
4-18	Ucanaanuc Marsh.....	36
4-19	Shirley Hill Road Wetlands.....	38
4-20	Perennial Tributary to Piscataquog & Associated Wetlands	40
4-21	Paige Hill Swamp.....	41
4-22	Juniper Drive Wetlands.....	42
4-23	Bog Brook Tributary	44
4-24	Hardy Brook Headwaters.....	45

Figures

Figure No.	Description
4-1	Gorham Brook Wetland
4-2	Gorham Brook Tributary & Associated Wetlands
4-3	Saunders Road Wetland
4-4	Snook Road Swamp
4-5	Beaver Pond/ Harry Brook Tributary Marsh
4-6	Upper Harry Brook
4-7	Middle Harry Brook, Northern, Central and Southern Associated Wetlands
4-8	Paige Hill Road Marsh
4-9	Stinson Road Marsh
4-10	Upper Black Brook Marsh
4-11	Lower Black Brook Marsh
4-12	Lower Harry Brook at Locust Hill Road
4-13	Piscataquog River Floodplain
4-14	Ucannonuc Marsh
4-15	Shirley Hill Road Wetlands
4-16	Perennial Tributary to the Piscataquog and Associated Wetlands
4-17	Paige Hill Swamp
4-18	Juniper Drive Wetlands
4-19	Roby Road Wetlands
4-20	Hardy Brook Headwaters Marsh
5-1	WVU – Ecological Integrity
5-2	WVU – Wetland Wildlife Habitat
5-3	WVU – Finfish Habitat
5-4	WVU – Educational Potential
5-5	WVU - Visual/Aesthetic Quality
5-6	WVU – Water-based Recreation
5-7	WVU – Flood Control Potential
5-8	WVU – Ground Water Use Potential
5-9	WVU – Sediment Trapping
5-10	WVU – Nutrient Attenuation
5-11	WVU – Shoreline Anchoring
5-12	WVU – Urban Quality of Life
5-13	WVU – Historical Site Potential
5-14	WVU – Noteworthiness
5-15	Average Functional Value Index
5-16	Total Wetland Value Units

1

Introduction

Under State of New Hampshire statute (RSA 482-A:15), communities like Goffstown are permitted to designate wetlands of exceptional value within their borders as “prime wetlands.” Once designated, these prime wetlands and a surrounding upland buffer are granted a higher level of protection, including greater scrutiny of applications for dredge and fill permits. This report provides a thorough and systematic study of all major wetland systems, which is a critical first step in identifying prime wetlands within Goffstown.

This Prime Wetlands Study report provides information on the major wetland systems in Goffstown, including a description of the geological and biological characteristics of each. Most importantly, this report provides quantitative data on the functional values performed by each wetland. The scores are for comparison only to other wetlands in Goffstown and do not necessarily reflect the scores that similar wetlands in other towns might receive (*e.g.*, where all wetlands may be scarce and hence found to be of high value). A critical component of the present study was the creation of a prime wetlands map (attached separately), which follows the strict standards specified in both NH RSA 482-A and the NH Wetlands Administrative Rules (Wt 700) dealing with prime wetlands.

To conduct the evaluation of candidate prime wetlands, VHB utilized the *Method for Comparative Evaluation of Nontidal Wetlands in New Hampshire* (Ammann and Stone 1991) that is recommended by the NH Department of Environmental Services (NHDES). This rigorous methodology focuses the evaluation on the most significant functions (from an ecosystem standpoint) and values (from a public benefit standpoint) provided by the wetlands.

To create the prime wetlands map, VHB used Geographic Information Systems (GIS) databases to identify important resource “layers,” Global Positioning Systems (GPS) techniques to accurately locate features and boundaries on the ground, and aerial photo-interpretation to supplement this information. All of this information was then combined with extensive field investigations to produce a map of proposed prime wetlands. A formal Public Hearing and town-wide referendum will be necessary before these candidate wetlands are officially designated as prime.

2

Environmental Setting

Goffstown lies in Hillsborough County in the south-central portion of New Hampshire. The town lies in the New England physiographic area characterized by hills and low mountains (Bond *et al.* 1981). Elevations vary from approximately 300 feet above sea level along the valley floor of the Piscataquog River to 1345 feet above sea level on the top of North Uncanoonuc Mountain.

Soils in this region are underlain by both metamorphic and igneous rocks. The metamorphic rocks are of the Littleton Formation, which is composed of gray mica schist, and of the Merrimac Group, which is composed of pinkish brown granulite and gray phyllite.

Igneous rock, comprised of granite, quartz monzonite, and granodiorite intrusions through the metamorphic rock, is found in the eastern half of Goffstown. This area is at the edge of the 25-mile long and 7-mile wide Fitchburg Pluton comprised of these granite-like rocks and running from Brookline northward through Manchester, NH (Bond *et al.* 1981).

The surficial geology (*i.e.*, soils) of Goffstown was formed during the late glacial period, some 14,000 to 10,000 years ago. The effect of the glacier is readily apparent upon inspection of the USGS topographic map for Goffstown. Surface features are elongated in a north-northwest to south-southeast direction reflecting the movement of the glacier over the landscape.

As the 1-mile deep ice sheet advanced southward and then retreated northward, it scraped and crushed surface deposits, which, as the glacier moved on, were deposited over bedrock - primarily as a mixture of boulders, stones, sands, and clay. This unsorted mixture is called "glacial till." As the glacier melted and retreated, other areas of the landscape were overlain with well-sorted sands and gravel deposited from rivers and streams draining from the glacier. These areas of "stratified drift" are noticeable on the landscape by so-called "glacial fluvial" features like eskers, kame terraces, and deltas, all comprised of well-sorted and layered deposits. These deposits are easily identified in Goffstown by the presence of sand and gravel pits, such as the pits off Locust Hill Road along Harry Brook or those along Black Brook Road.

Stratified-drift areas provide an especially important hydrological support for wetlands because of their groundwater quantity and quality, and long-term predictability of the underlying aquifer. Wetlands overlying these areas typically are groundwater discharge areas, contributing a “base flow” to outlet streams (readily identified by their cold water temperatures). Approximately 5.6 square miles of Goffstown or 15 percent of its land area is underlain by stratified drift aquifer (USGS 1995).

The General Soil Map for the eastern part of Hillsborough County shows five major soil associations in Goffstown (Bond *et al.* 1981):

- Hinckley-Windsor - excessively drained, gravelly and sandy soils on terraces, *e.g.*, Piscataquog River valley floor.
- Canton-Chatfield - well drained, loamy soils on hilly uplands, *e.g.*, most of the land area between the mountains.
- Paxton-Woodbridge - well drained, loamy soils on uplands, *e.g.*, north-central part of Goffstown between Gorham Brook and Harry Brook.
- Hollis-Chatfield-Canton - somewhat excessively drained and well drained, loamy soils on hills and low mountains, *e.g.*, the Uncanoonuc Mountains and a hilly area east of Catamount Brook to the town line, and
- Urban land-Windsor-Canton - excessively drained and well drained, sandy and loamy soils on terraces and uplands, *e.g.*, Goffstown Village and Pinardville areas.

Typical wetland soils are contained in practically all of these associations, but especially in the Urban land-Windsor-Canton, Hinckley-Windsor, and Canton-Chatfield coverage areas of Goffstown.

In general, wetlands are more widely distributed in the north end of Goffstown where the terrain is gently rolling hills as compared to the south end where six distinct mountains or steep hills exist (*i.e.*, North and South Uncanoonuc Mountains, Worthley Hill, Yacum Hill, Shirley Hill and Walnut Hill). In the southern end of town most surface water features are valley streams, and wetlands are relatively less common due a number of factors including the steeper terrain.

Additionally, the character of the wetlands in each part of the community is affected by the soils and parent material in the vicinity. The drumlin landforms (*i.e.*, low hills formed by glacial action), which are relatively common in the northern portion of Goffstown tend to be composed of unsorted and compact ice-contact sediments (“glacial till”) which often contain a high percentage of fine materials. These soils are consequently less permeable to water. Conversely, the highly sorted, sandy deposits

associated with the pro-glacial lakebeds along the Piscataquog valley tends to be relatively more permeable. These soils types generally do not allow formation of “perched” systems, which limits the distribution of wetlands to areas of active groundwater discharge.

3

Methodology

3.1 Existing Information Retrieval and Base Map Development

An appropriate base map for overlaying the boundaries of candidate prime wetlands was created using digital, false-color ortho-photos dated April 26, 2001 supplied by the Town of Goffstown. Physical features, including public roads and watercourses, were added from the GRANIT GIS database maintained by the University of New Hampshire. Other information that was collected included:

- Zoning and Tax Parcel Boundaries (supplied by Goffstown)
- USGS Topographic Quadrangles covering Goffstown (4 total - Manchester South, Pinardville, Weare, and Goffstown)
- NRCS Hydric Soils Mapping (GRANIT)
- Fish Stocking Information (NH Fish and Game Department)
- NH 305(b) Water Quality Report to Congress
- FEMA Floodplain Maps (GRANIT)
- National Wetlands Inventory (NWI) Maps (GRANIT)
- NHDES Well Inventory Data
- USGS Stratified Drift Aquifer Mapping (GRANIT)
- USGS Surficial Geology Mapping (GRANIT)
- Land Use Mapping (GRANIT)
- Conservation Lands (GRANIT)
- National Register of Historic Places
- NH Natural Heritage Inventory Data

The boundaries of all watersheds, including sub-watersheds, were determined using a combination of GRANIT information and visual inspection of the USGS-based topography. Terrain Navigator Pro® software, which provides a high resolution digital file of the USGS quadrangles, was used to facilitate this watershed delineation.

3.2 Field Investigations and Mapping

3.2.1 Initial Screening of Wetlands

A combination of GIS analysis and field inspections were used to screen wetland systems for evaluation.

The criteria developed for identifying candidate prime wetlands for detailed field investigation included:

1. All 5-acre or larger wetlands or wetland complexes mapped by the National Wetlands Inventory (US Fish & Wildlife Service).
2. Those 5-acre or larger NWI wetlands that are also dominated (*i.e.*, greater than 50 percent area) by very poorly drained soils.
3. Wetlands that are narrow and linear complexes were selected against for this study (*i.e.*, narrow riparian wetlands that occupy only the immediate vicinity of a stream channel). Instead, those riverine influenced wetlands with large expanses of associated marsh, scrub/shrub, and/or forested wetlands as detailed by NWI mapping or aerial photo interpretation were recognized as potentially prime wetlands.

From this the largest wetland complexes were extracted from the remaining group of wetlands. Additionally, preliminary field visits were conducted during screening to help develop a list of potential prime wetlands for further evaluation. Coordination with the Conservation Commission was also conducted to ensure complete coverage of wetland systems.

3.2.2 Mapping/Boundary Determinations

The wetland base map and overlays were originally compiled into a GIS-based project. These data were incorporated into an ArcPad program, a mobile GIS-based application, running on a Dell Axim Pocket PC, equipped with a Pharos GPS receiver.

Prime wetland boundaries were drawn directly onto base maps as the investigator traversed a wetland's edge. The GPS system was used in conjunction with the ArcPad application to locate each wetland's edge. At a regular interval, the investigator would stop along the wetland's edge, acquire a GPS location point in the ArcPad application, and transfer this information onto a base map that corresponded to the GPS-location.

The Position Dilution of Precision (PDOP) is a measurement of the accuracy of the GPS device at the time of survey data point acquisition. The average PDOP ratio during prime wetland delineations was six (6) or less, resulting in a GPS accuracy of three (3) meters or less. This far exceeds the mapping accuracy standard of ± 100 feet required by NHDES for prime wetland mapping.

Once a wetland complex was completely delineated, the base map was scanned at high resolution (600 dpi), digitized in AutoCAD, and imported into ArcMap to create the final prime wetlands candidate map.

3.3 Functions and Value Assessment

A total of 24 wetlands were selected for further evaluation for their prime wetland status. All were evaluated using the procedures outlined in the NH Method (Ammann and Stone 1991). This procedure requires that the wetlands be scored on a minimum of 14 functional values described as follows:

1. **Ecological Integrity** – Evaluates the overall health and function of the wetland ecosystem.
2. **Wetland Wildlife Habitat** – Evaluates the suitability of the wetland as habitat for those animals typically associated with wetlands and wetland edges. No single species is emphasized.
3. **Finfish Habitat** – Evaluates the suitability of watercourses, ponds, or lakes associated with the wetland for either warm water or cold water fish. No single species or group of species is emphasized.
4. **Educational Potential** – Evaluates the suitability of the wetland as a site for an “outdoor classroom.”
5. **Visual Aesthetic Quality** – Evaluates the visual and aesthetic quality of the wetland.
6. **Water-based Recreation** – Evaluates the suitability of the wetland and associated watercourses for non-powered boating, fishing, and other similar recreational activities.
7. **Flood Control Potential** – evaluate the effectiveness of the wetland in storing floodwaters and reducing downstream flood peaks.
8. **Ground Water Use Potential** – Evaluates the potential use of the underlying aquifer as a drinking water supply.
9. **Sediment Trapping** – Evaluates the potential of the wetland to trap sediment in runoff water from surrounding upland.
10. **Nutrient Attenuation** – Evaluates the potential of the wetland to reduce the impacts of excess nutrients in runoff water on downstream lakes and streams.
11. **Shoreline Anchoring and Dissipation of Erosive Forces** - Evaluates the effectiveness of the wetland in preventing shoreline erosion.
12. **Urban Quality of Life** (as influenced by Wetland Wildlife Habitat, Educational Opportunity, Visual/Aesthetic Quality, and Water-based

Recreation values) – Evaluates the potential for the wetland to enhance the quality of urban life by providing wildlife habitat and other natural values in an urban setting.

13. **Historical Site Potential** – Evaluates for indications of use by early settlers.
14. **Noteworthiness** – Evaluates the wetland for certain special values such as critical habitat for endangered species, *etc.*

With the NH Method, scoring for each functional value (with one exception) is weighted based on the size of the wetland with the presumption that larger wetlands provide a greater value or benefit. The one exception, Noteworthiness, is intended to balance this bias and ensure that small wetlands that are of particular importance, such as bogs or small wetlands with rare species, are identified and considered for prime wetland designation.

Using the base map and data collected in the field, we completed a series of standard data sheets to calculate an average Functional Value Index (FVI) for each of the 14 functional values for the 24 wetlands. These data were then entered into a customized electronic spreadsheet that automatically calculated an average for each Functional Value and then multiplied them by wetland size (in acres), to provide a total number of Wetland Value Units (WVUs) for the particular wetland.

In order to provide a quick comparison among the candidate wetlands, we also calculated an average FVI and average WVU for each candidate wetland. Intuitively, these latter averages provide an index to both “quality” of the wetland as well as the “quantity” of its value.

4

Candidate Prime Wetlands

4.1 Gorham Brook Wetlands

Gorham Brook is a 2nd order stream that runs from Gorham Pond in Dunbarton, south to the Piscataquog River in Goffstown along the New Boston town line. The brook runs through a 300 to 1,000-foot wide valley with fairly steep side slopes. The wetlands lining Gorham Brook extend south along the valley bottom approximately 4,500 feet from the Dunbarton town line (see **Figure 4-1**).

Gorham Pond Road runs along the eastern side of this riparian corridor. Moderate rural residential development exists along this road, along with a small-scale agricultural operation. The Kuncanowet Hills run north to south along the corridor's western side. A mature, mixed hardwood forest is the dominant plant community up slope of the wetlands.

The Gorham Brook wetlands (approximately 49 acres in size) are influenced significantly by beaver (LATIN) activity and to a lesser extent by an old dam with flashboards that was in disrepair. A large, approximately 300-foot beaver dam runs east-west across the central portion of the wetland, creating a 0.34-acre impoundment. Recent beaver activity (*e.g.*, cut stumps) was observed along the entire western side of the wetland. The blown out dam lies at the southern end of the wetland, just north of the utility line crossing of Gorham Brook. Wood duck boxes are located just north of the dam, indicating that the area may have been maintained as a wildlife management area prior to the dam blow-out.

The approximately 20-foot wide defined channel of Gorham Brook runs the entire length of the wetland complex. Flow within the brook's channel is relatively stagnant, except in the vicinity of the beaver dam and the outlet. The low-flow characteristics of this portion of Gorham Brook has allowed for the development of dense emergent vegetation to the east and west of the stream channel, ranging from 50 to 350 feet in width. Scrub-shrub and forested wetlands border the emergent wetlands and the surrounding uplands around the majority of the wetland complex.

Soils within this wetland complex are characterized by NRCS as nearly level Borohemists and ponded, very poorly drained soils. Vegetation observed includes sedge (*Carex* spp.), jewel weed (*Impatiens capensis*), pickerel weed (*Pontederia cordata*), arrow arum, bluejoint (*Calamagrostis canadensis*), wool-grass (*Scirpus cyperinus*),

cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), **arrow-wood** (*Viburnum dentatum*), peat moss (*Sphagnum* sp.), spirea (*Spiraea* sp.), high-bush blueberry (*Vaccinium corymbosum*), speckled alder (*Alnus rugosa*), and red maple.

This wetland complex is the largest investigated for prime wetlands status in Goffstown. It is an intact system with relatively little human disturbance, although it is in the vicinity of an area undergoing moderate development pressure. Signs of moose (LATIN) and deer (LATIN) were evident in and around the wetland. The diversity of habitat types and their interspersions, including the open stream channel and ponded areas, enhance the importance of this wetland complex to migrating waterfowl. This wetland complex scored high for ecological integrity, wetland wildlife habitat, flood control potential, and ground water use potential.

Table 4-1.
Gorham Brook Wetland Summary (48.8 acres)

Wetland Functional Value	FVI	WVU
1. Ecological Integrity	0.80	39.1
2. Wetland Wildlife Habitat	0.89	43.5
3. Finfish Habitat: Part A - Rivers and Streams	0.88	4.2
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.72	3.6
5. Visual Aesthetic Quality	0.89	15.1
6. Water-based Recreation	0.80	3.8
7. Flood Control Potential	0.90	43.9
8. Ground Water Use Potential	0.83	40.7
9. Sediment Trapping: Part A	0.75	36.6
9. Sediment Trapping: Part B	0.65	31.7
9. AVERAGE	0.70	34.2
10. Nutrient Attenuation: Part A	0.63	30.5
10. Nutrient Attenuation: Part B	0.69	31.7
10. AVERAGE	0.66	31.1
11. Shoreline Anchoring and Dissipation of Erosive Forces	1.00	2.8
12. Urban Quality of Life: A. Presence of an Urban Setting	0.63	14.6
12. Urban Quality of Life: B. Wetland Wildlife Habitat	1.00	48.8
12. Urban Quality of Life: C. Educational Opportunity	0.88	4.4
12. Urban Quality of Life: D. Visual/Aesthetic Quality	1.00	17.0
12. Urban Quality of Life: E. Water-based Recreation	1.00	4.8
13. Historical Site Potential	0.63	30.5
14. Noteworthiness	0.29	14.0

4.2 Gorham Brook Tributary and Associated Wetlands

An intermittent tributary to Gorham Brook with about 10.6 acres of forested and emergent wetlands is located approximately ¼ of a mile due east of the southern portion of the Gorham Brook Wetlands. A utility line right-of-way runs west-east from the southern extent of the Gorham Brook Wetlands to the southern extent of the Wetlands Associated with Gorham Brook. An ATV trail follows the right-of-way, providing the best access to the wetland from Gorham Pond Road to the west.

Immediately surrounding this wetland is a mixed hardwood forest to all sides. Logging activity appears to have occurred 15+ years ago on the wetland's eastern side. A moderate level of rural residential development is located to the wetland's western side at a distance of 500 feet, while dense rural development is present to the north along Snook Road at a distance of 1000 feet.

This wetland is a fairly small wetland complex, amounting to 10.6-acres. The wetland is composed of a small north to south grading valley, with a 30-foot beaver dam at the wetlands southern end. An intermittent stream enters the wetland from the east, which drains wetlands from the northern side of Snook Road and closer. The wetland drains via an upper perennial stream west to Gorham Brook.

The wetland is characterized by approximately 1 acre of open water impounded by the beaver dam, surrounded by emergent marsh. The beaver dam appears to be inactive, as evidenced by hydrologic indicators that the beaver pond elevation was 2-3 feet higher within the past few years. No recent beaver activity was observed. Forested wetland borders the emergent vegetation to the north and east. The forested wetland is well-developed pit and mound microtopography, and narrows and drains north at the northern end. This portion of the wetland is poorly drained, but is frequented by deer and moose as evidenced by scat, numerous wildlife trails, and tracks. Hemlock (*Tsuga Canadensis*) has a strong presence in a portion of the forested wetland. This area may be a valuable deer wintering yard due to its location within a valley and its vegetative cover.

Soils are characterized by NRCS as Chocorua Mucky Peat (very poorly drained) to the south, and Leicester-Walpole Complex (poorly drained) to the north. Vegetation observed includes sedges, blue joint, cinnamon fern, royal fern, broad-leaf cattail (*Typha latifolia*), peat moss, steeplebush (*Spirea latifolia*), high-bush blueberry, red maple, gray birch (*Betula populifolia*), eastern white pine (*Pinus strobus*), eastern hemlock, and yellow birch (*Betula alleghaniensis*). One 20-foot diameter stand of dense phragmites was discovered along the wetland's eastern edge.

This pristine wetland complex is nicely buffered by forested habitat from human development and disturbance, and thus ranked very highly for its ecological integrity and aesthetics. Numerous amphibians species, including wood frogs (*Rana sylvatica*), green frogs (*Rana clamitans*), and garter snakes (*Thamnophis sirtalis*) were

observed, in addition to the wildlife signs described above. This scored the complex highly for wetland wildlife habitat. Finally, the wetland is highly valued for its groundwater use potential.

**Table 4-2
Gorham Brook Tributary and Associated Wetlands (10.6 acres)**

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	1.00	10.6
2. Wetland Wildlife Habitat	0.76	8.0
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.72	0.6
4. Educational Potential	0.69	1.9
5. Visual Aesthetic Quality	0.88	4.4
6. Water-based Recreation	0.50	0.0
7. Flood Control Potential	0.50	5.3
8. Ground Water Use Potential	0.83	8.8
9. Sediment Trapping: Part A	0.30	3.2
9. Sediment Trapping: Part B	0.66	7.0
9. AVERAGE	0.48	5.1
10. Nutrient Attenuation: Part A	0.20	2.1
10. Nutrient Attenuation: Part B	0.59	7.0
10. AVERAGE	0.40	4.6
11. Shoreline Anchoring and Dissipation of Erosive Forces	1.00	0.3
12. Urban Quality of Life: A. Presence of an Urban Setting	0.20	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.38	4.0
14. Noteworthiness	0.14	1.5

4.3 Saunders Road Wetlands

The Saunders Road Wetlands are bisected by Saunders Road, which connects to Gorham Pond Road from the east. The wetlands are approximately 600 feet east of the intersection. Dense rural residential development lies just west of the wetland's western edge. Scattered residences lie further to the north and east, but the majority of the wetlands northern, eastern, and southern sides are buffered by a softwood forest.

The wetland complex, approximately nine acres in size, is set at the western base of a north-south aligned hillside. The hillside to the wetland's east is fairly large, while the topography to the west grades up to a much lesser extent. The wetland is very

flat, and drains ever so slightly to the south and outlets to a narrow channel that flows directly into the Piscataquog River. An intermittent stream enters the wetland from the north, as does one from the east.

High interspersion of vegetative cover classes is characteristic of this wetland. Habitat within the wetland is a mixture of aquatic bed, emergent marsh, scrub-shrub, and forested wetland types. These small units are not shown on **Figure 4-3**, as it would have been extremely difficult to map cover types to such a micro-level scale.

Soils at the Saunders Road Wetlands are characterized by NRCS as Greenwood Mucky Peat, a very poorly drained soil. The wetland supports a healthy population of sapling and mature black gum (*Nyssa sylvatica*), and a large number of sapling American chestnut (*Castanea dentata*). Additional vegetation observed included sedges, jewel weed, pickerel weed, duckweed (*Spirodela oligorrhiza*), poison ivy (*Toxicodendron radicans*), cinnamon fern, sensitive fern, royal fern, broad-leaf cattail, peat moss, purple loosestrife (*Lythrum salicaria*), spirea, elderberry (*Sambucus canadensis*), high-bush blueberry, common winterberry (*Ilex verticillata*), silky dogwood (*Cornus amomum*), speckled alder, red maple, American elm (*Ulmus americana*), and gray birch.

This wetland is one of the smallest and lowest overall scoring wetland systems investigated. However, it is noteworthy because of its black gum population, and its great interspersion of cover types. It received good scores for its ecological integrity and its wetland wildlife habitat.

Table 4-3
Saunders Road Wetland (8.9 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.83	7.4
2. Wetland Wildlife Habitat	0.84	7.5
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.65	1.6
5. Visual Aesthetic Quality	0.79	2.4
6. Water-based Recreation	0.00	0.0
7. Flood Control Potential	0.60	5.3
8. Ground Water Use Potential	0.83	7.4
9. Sediment Trapping: Part A	0.30	2.7
9. Sediment Trapping: Part B	0.58	5.1
9. AVERAGE	0.44	3.9
10. Nutrient Attenuation: Part A	0.20	1.8
10. Nutrient Attenuation: Part B	0.57	5.1
10. AVERAGE	0.39	3.5
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.00	0.0

Table 4-3 (Continued)

Wetland Functional Values	FVI	WVU
12. Urban Quality of Life: A. Presence of an Urban Setting	0.20	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.05	0.4
14. Noteworthiness	0.29	2.5

4.4 Snook Road Swamp

Snook Road Swamp is located approximately 500 feet south of Snook Road, and ¼ mile west of NH 13. A skidder trail connects Snook Road to the swamp at the wetland's northeastern corner. It is isolated from human development and/or disturbance by a mature mixed hardwood forest on all sides. The wetland evaluation unit is approximately 24.6 acres.

The wetland is situated in a shallow basin, with one upper perennial stream input from the east, and one steep, narrow upper perennial channel that drains the swamp to the south into the Piscataquog River. The swamp has an 80-foot beaver dam that impounds permanent, shallow open water. This results in a complex dominated by aquatic bed wetlands, with emergent vegetation bordering the entire open water area, and some inclusions of forested wetland. The wetlands surface water elevation appears to have change fairly dramatically over the past years. This is evidenced by forested wetlands that have been flooded, and perimeter wetland areas that appear to have been flooded in the past but are currently fairly dry. This may reflect a cyclic beaver population occupying the swamp.

The vegetative cover type distribution in this system is fairly homogenous. Despite this, the wildlife habitat is of great value. A great blue heron (*Ardea herodias*) rookery is located in the southeastern cove of the wetland, with a total of six nests observed. Numerous belted king fishers (*Ceryle alcyon*) were observed, along with a female greater scaup (*Aythya marila*). Deer and moose tracks were also observed throughout the perimeter of the wetland. A healthy amphibian and reptile population was present, including bullfrogs (*Rana catesbeiana*), green frogs, wood frogs, and painted turtles (*Chrysemys picta picta*). A neighbor indicated that the wetland provides excellent hunting opportunities.

Snook Road Swamp's soils are characterized by NRCS as Poneded Borohemists, a very poorly drained soil. Vegetation observed included sedge, duckweed, wool-grass, cinnamon fern, royal fern, broad-leaf cattail, peat moss, high-bush blueberry, and red maple.

This wetland system has the least amount of human influence and disturbance of any of the wetland systems investigated. The heron rookery is an uncommon feature, and reflects how buffered this system is from human activity. It is aesthetically rich, and has high scores for its flood control potential, shoreline anchoring and dissipation of erosive forces, and its noteworthiness.

Table 4-4
Snook Road Swamp (24.6 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.94	23.1
2. Wetland Wildlife Habitat	0.85	21.0
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.83	13.2
4. Educational Potential	0.61	4.3
5. Visual Aesthetic Quality	0.89	5.3
6. Water-based Recreation	0.67	16.4
7. Flood Control Potential	1.00	24.6
8. Ground Water Use Potential	0.40	9.9
9. Sediment Trapping: Part A	0.30	7.4
9. Sediment Trapping: Part B	0.76	18.7
9. AVERAGE	0.53	13.1
10. Nutrient Attenuation: Part A	0.20	4.9
10. Nutrient Attenuation: Part B	0.74	18.7
10. AVERAGE	0.47	11.8
11. Shoreline Anchoring and Dissipation of Erosive Forces	1.00	1.7
12. Urban Quality of Life: A. Presence of an Urban Setting	0.20	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.15	3.7
14. Noteworthiness	0.43	10.6

4.5 Beaver Pond/Harry Brook Tributary Marsh

The Beaver Pond/Harry Brook Tributary Marsh, one of the largest wetland systems evaluated at more than 41 acres, is located along Goffstown's northern town line, just west of NH 13. Beaver Pond in Dunbarton supplies the majority of this system's hydrology, which drains southeast into the marsh. The marsh eventually drains into Harry Brook via an intermittent stream.

Surrounding land use includes a mature mixed softwood forest to the north, southeast, and south. A mixed hardwood forest abuts the wetland to the west. This

complex is nicely buffered from human activity and development on all sides by these forests except for a 700-foot strip along the northeastern side, where rural residential use exists.

Beaver activity has created a small amount of open water habitat to the wetlands northwestern corner. The rest of the wetland complex is a combination of highly interspersed emergent, scrub-shrub, and forested wetland types. Soils are saturated to the surface throughout the vast expanse of this flat wetland, with approximately 20% or more of scattered open water pockets. Evidence of moose, deer, and bear (*Ursus americanus*) were observed. During a conversation with a landowner abutting the wetland, VHB environmental scientists learned that a diversity of wildlife are observed moving through and along this wetland including moose, deer, bear, coyotes (*Canis latrans*), fisher cats (*Martes pennanti*), and a plethora of songbirds. The wetland is also host to a healthy population of green frogs and wood frogs.

Soils within this wetland complex are characterized by NRCS as nearly level Borohemists, which are very poorly drained soils. Vegetation observed includes sedge, jewel weed, pickerel weed, duckweed, horsetail (*Equisetum* sp.), poison ivy, bristly blackberry (*Rubus hispidus*), cinnamon fern, sensitive fern, royal fern, lady fern (*Athyrium filix-femina*), wool-grass, broad-leaf cattail, peat moss, spirea, high-bush blueberry, arrow-wood speckled alder, red maple, American elm, green ash (*Fraxinus pennsylvanica*), and eastern white pine.

This wetland scored very high for its ecological integrity, and clearly serves as very important habitat for a range of wildlife species. The broad expanse of this flat marsh, with the addition of abutting intact-upland forests around the majority of its perimeter, is a distinct and valuable feature. This wetland complex also scored high for flood control potential, sediment trapping, nutrient attenuation, shoreline anchoring and dissipation of erosive forces, and its noteworthiness.

Table 4-5
Beaver Pond/Harry Brook Tributary Marsh (41.4 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	1.00	41.4
2. Wetland Wildlife Habitat	0.90	37.2
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.77	0.1
4. Educational Potential	0.62	25.8
5. Visual Aesthetic Quality	0.78	9.3
6. Water-based Recreation	0.51	0.1
7. Flood Control Potential	1.00	41.4
8. Ground Water Use Potential	0.53	22.1
9. Sediment Trapping: Part A	0.50	20.7
9. Sediment Trapping: Part B	0.80	33.1
9. AVERAGE	0.65	26.9

Table 4-5 (Continued)

Wetland Functional Values	FVI	WVU
10. Nutrient Attenuation: Part A	0.50	20.7
10. Nutrient Attenuation: Part B	0.70	33.1
10. AVERAGE	0.60	26.9
11. Shoreline Anchoring and Dissipation of Erosive Forces	1.00	0.1
12. Urban Quality of Life: A. Presence of an Urban Setting	0.50	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.15	6.2
14. Noteworthiness	0.43	17.7

4.6 Upper Harry Brook & Associated Wetlands

This wetland complex was evaluated as two separate wetland units because the wetland narrows to a width of 50 feet in its mid section, therefore requiring two prime wetland assessments.

The Upper Harry Brook Associated Wetlands are located along Goffstown's northern town line, west of Tibbetts Hill Road. Surrounding land is dominated by a mixed northern forest. The northern portion of the wetland has a single residence on its northern side.

4.6.1 Upper Harry Brook & Northern Associated Wetlands

This system is dominated by the upper perennial Harry Brook, meandering south with a strong aggressive beaver damming at the evaluation unit's outlet. The beaver dams appear to have been human modified to restore the brook's flow, but still impound a small area of unconsolidated bottomed open water. The riparian wetland is dominated by emergent vegetation, and to a lesser extent, scrub-shrub vegetation.

Soils within this wetland system are characterized by NRCS as Scarboro Stony Mucky Loamy Sand, a very poorly drained soil. Vegetation observed includes sedge, royal fern, sensitive fern, joe-pye weed, purple loosestrife, lesser bur-reed (*Sparganium americanum*), boneset (*Eupatorium perfoliatum*) bristley blackberry, tall goldenrod (*Solidago altissima*), speckled alder, silky dogwood, spirea, and red maple.

This wetland's most notable feature is its flood control potential. It has good ecological integrity and wetland wildlife habitat, despite the large residence abutting its northern side. The strong riverine influence on this riparian wetland system is

reflected by the low scores it received for many of the prime wetland functions and values.

Table 4-6
Upper Harry Brook & Northern Associated Wetlands (5.7 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.88	5.0
2. Wetland Wildlife Habitat	0.85	4.8
3. Finfish Habitat: Part A - Rivers and Streams	0.53	0.4
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.66	3.7
5. Visual Aesthetic Quality	0.61	1.2
6. Water-based Recreation	0.58	0.4
7. Flood Control Potential	1.00	5.7
8. Ground Water Use Potential	0.40	2.3
9. Sediment Trapping: Part A	0.30	1.7
9. Sediment Trapping: Part B	0.48	2.7
9. AVERAGE	0.39	2.2
10. Nutrient Attenuation: Part A	0.40	2.3
10. Nutrient Attenuation: Part B	0.60	2.7
10. AVERAGE	0.50	2.5
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.67	0.5
12. Urban Quality of Life: A. Presence of an Urban Setting	0.40	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.28	1.6
14. Noteworthiness	0.14	0.8

4.6.2 Upper Harry Brook & Southern Associated Wetlands

This wetland evaluation unit is very similar in character to that of its northern counterpart. One main difference is the dominance of scrub-shrub vegetation throughout this stretch of riparian wetland, with more limited emergent vegetation.

Soils within this wetland system are characterized by NRCS as Scarboro Stony Mucky Loamy Sand, a very poorly drained soil. Vegetation observed in addition to the northern evaluation unit includes arrow-arum, pickerelweed, wool-grass, and broad leaf cattail.

This wetland had very similar scores to the northern evaluation unit, with the exception that it did not score especially well for its flood control potential (due to its small size), but instead scored very well for its ecological integrity. This is because this evaluation unit is much more isolated from human impacts and disturbance.

Table 4-7
Upper Harry Brook & Southern Associated Wetlands (2.4 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.96	2.3
2. Wetland Wildlife Habitat	0.85	2.0
3. Finfish Habitat: Part A - Rivers and Streams	0.59	0.1
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.66	1.6
5. Visual Aesthetic Quality	0.79	1.6
6. Water-based Recreation	0.56	0.1
7. Flood Control Potential	0.70	1.7
8. Ground Water Use Potential	0.40	0.9
9. Sediment Trapping: Part A	0.30	0.7
9. Sediment Trapping: Part B	0.52	1.2
9. AVERAGE	0.41	1.0
10. Nutrient Attenuation: Part A	0.40	0.9
10. Nutrient Attenuation: Part B	0.61	1.2
10. AVERAGE	0.50	1.1
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.67	0.2
12. Urban Quality of Life: A. Presence of an Urban Setting	0.40	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.28	0.7
14. Noteworthiness	0.14	0.3

4.7 Middle Harry Brook & Associated Wetlands

This wetland system comprised of approximately 34 acres was divided into three separate evaluation units as the wetland narrows to a width of 50 feet in two locations along its length. Therefore, the Middle Harry Brook and Associated Wetlands include northern, central, and southern portions.

This wetland system is riverine as it lies in the Harry Brook floodplain east of Hillcrest Road. It is primarily an emergent marsh along a low gradient meandering stream channel flowing to the south east. Numerous beaver dams are present throughout the system.

4.7.1 Middle Harry Brook and Northern Associated Wetlands

This northern portion of the wetland is a forested swamp of approximately 3.6 acres. Soils here are characterized in the NRCS Soil Survey as primarily ponded Borehemists.

This portion features a slow moving, meandering brook, approximately 4 to 5 feet wide that is 6-12 inches deep and has a natural sheen on the water surface. Several channels that enter and exit the main channel are smaller, 2 to 3 foot wide and approximately 4 inches deep. A majority of these smaller channels occurs under the canopy of the red maple (*Acer rubrum*) forested wetland and scrub shrub where the brook emerges. Aquatic vegetation including lesser bur-reed, ribbon-leaf pondweed (*Potamogeton epihydrus*), arrow-arum (*Peltandra virginica*) and water lily (*Nymphaea* spp.) occur in scattered locations throughout the length of the brook. The adjacent wetland is dense, primarily emergent wetland (PEM/PSS1B), but is interwoven with areas of scrub shrub. The margins of the wetland are mostly 10-foot high scrub-shrub (PSS1B) before transitioning into a red maple forested wetland (PFO1B).

Vegetation in the emergent marsh portion includes wool-grass, spotted touch-me-not (*Impatiens capensis*), cattail (*Typha latifolia*), soft rush (*Juncus effusus*), sensitive fern, fowl meadow grass (*Glyceria striata*), nodding sedge (*Carex gynandra*), three way sedge (*Dulichium arundinaceum*), shallow sedge (*Carex lurida*), bearded sedge (*Carex comosa*). Shrubs are interspersed with this emergent vegetation and include maleberry (*Lyonia ligustrina*), steeple-bush (*Spiraea tomentosa*), and arrow-wood (*Viburnum dentatum*).

The scrub-shrub wetlands consist of speckled alder (*Alnus rugosa*), silky dogwood (*Cornus amomum*), arrow-wood, steeple-bush; cinnamon (*Osmunda cinnamomea*), royal (*Osmunda regalis*) and, sensitive fern; and spotted touch-me-not. The red maple forest wetland consists of red maple, American hornbeam (*Carpinus caroliniana*), hemlock (*Tsuga canadensis*), and cinnamon fern.

The control length for the limits of this portion of the wetland is approximately 5 feet, consisting of an old beaver dam.

The principle functional values of this wetland, as reflected by its FVIs, are ecological integrity, wetland wildlife habitat, visual/aesthetic quality, and flood control.

Table 4-8
Middle Harry Brook and Northern Associated Wetlands (3.6 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.92	3.3
2. Wetland Wildlife Habitat	0.76	2.7
3. Finfish Habitat: Part A - Rivers and Streams	0.48	0.2
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.65	2.3
5. Visual Aesthetic Quality	0.83	1.7
6. Water-based Recreation	0.50	0.2
7. Flood Control Potential	1.00	3.6
8. Ground Water Use Potential	0.70	2.5
9. Sediment Trapping: Part A	0.30	1.1
9. Sediment Trapping: Part B	0.66	2.4
9. AVERAGE	0.48	1.7
10. Nutrient Attenuation: Part A	0.40	1.4
10. Nutrient Attenuation: Part B	0.64	2.4
10. AVERAGE	0.52	1.9
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.67	0.2
12. Urban Quality of Life: A. Presence of an Urban Setting	0.40	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.53	1.9
14. Noteworthiness	0.00	0.0

4.7.2 Middle Harry Brook and Central Associated Wetlands

This portion, approximately 5.7 acres, is much like the northern system described above. The vegetation diversity is equivalent. However, there are different vegetation communities. Forested red maple wetland and scrub-shrub do not exist to the extent that they did in the northern portion. It is mostly an emergent/scrub-shrub mosaic, of the same species as the northern portion. Along the margins are areas of scrub-shrub of the same species as upstream. In addition, the channel is larger, which in some areas is 10-12 feet across with a cobble bottom, rather than a mud or organic bottom upstream. The influence of beavers is much more evident as well. More areas of open water and aquatic bed occur. Pickerelweed (*Pontederia cordata*) is the most dominant aquatic in this portion of the system.

Wetland soils in this portion are characterized by NRCS as ponded Borochemists

The principle functional values of this wetland, as reflected by its FVIs, are ecological integrity, wetland wildlife habitat, visual/aesthetic quality, flood control, and shoreline protection,

Table 4-9
Middle Harry Brook and Central Associated Wetlands (5.7 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.88	5.0
2. Wetland Wildlife Habitat	0.80	4.5
3. Finfish Habitat: Part A - Rivers and Streams	0.48	0.2
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.58	3.3
5. Visual Aesthetic Quality	0.75	2.2
6. Water-based Recreation	0.49	0.2
7. Flood Control Potential	1.00	5.7
8. Ground Water Use Potential	0.70	4.0
9. Sediment Trapping: Part A	0.30	1.7
9. Sediment Trapping: Part B	0.48	2.7
9. AVERAGE	0.39	2.2
10. Nutrient Attenuation: Part A	0.40	2.3
10. Nutrient Attenuation: Part B	0.60	2.7
10. AVERAGE	0.50	2.5
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.83	0.4
12. Urban Quality of Life: A. Presence of an Urban Setting	0.40	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.53	3.0
14. Noteworthiness	0.14	0.8

4.7.3 Middle Harry Brook and Southern Associated Wetlands

In this downstream most portion, Harry Brook meanders through the associated wetlands in a 12 to 15-foot wide channel with cobble bottom. The brook does have numerous smaller channels that lead to and from that stretch out to other areas of the wetland. All the channels ultimately led to an area of open water at the southern limit of the wetland before it funnels through a beaver dam into a hemlock forest.

The associated wetlands are mainly a mosaic of emergent marsh and scrub shrub areas scrub-shrub dominates with the plant species as listed for the northern and central portions. Silky dogwood, arrow-wood, speckled alder, maleberry, and red

maple (mostly along the margins) are dispersed throughout the wetland. Since this wetland contains more open water, the aquatics are much more abundant. The aquatics are dominated by pickerelweed, arrow-arum.

At the southern limit of this wetland system is an area of open water formed by the slow release of the water to the brook channel. This end contains an abrupt transition from bank to upland using large boulders that create the sides of the channel before and in the hemlock forest. The wetland ends when it reaches a beaver dam approximately 10 feet wide. A control length of about 12 feet exists.

Upland surrounds this wetland system. On the western side an oak (*Quercus* spp.)/white pine (*Pinus strobus*) mixed forest occurs. On the eastern side, the upland is dominated by white pine and hemlock. There is some residential development on the western side of the system; however, it is far enough away that you still feel isolated within this wetland. The eastern side has no development nearby.

Soils underlying this portion of the wetland system are characterized in the NRCS Soil Survey as including ponded Borohemists, Scituate stony fine sandy loam, and Canton stony fine sandy loam.

The principle functional values of this candidate wetland, as reflected by its FVIs, are ecological integrity, wetland wildlife habitat, visual/aesthetic quality, flood control, ground water use potential, nutrient attenuation and shoreline protection,

Table 4-10
Middle Harry Brook and Southern Associated Wetlands (24.4 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.88	21.4
2. Wetland Wildlife Habitat	0.85	20.7
3. Finfish Habitat: Part A - Rivers and Streams	0.53	1.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.69	4.8
5. Visual Aesthetic Quality	0.84	2.5
6. Water-based Recreation	0.51	1.0
7. Flood Control Potential	0.70	17.1
8. Ground Water Use Potential	0.70	17.1
9. Sediment Trapping: Part A	0.30	7.3
9. Sediment Trapping: Part B	0.52	12.7
9. AVERAGE	0.41	10.0
10. Nutrient Attenuation: Part A	0.40	9.8
10. Nutrient Attenuation: Part B	0.73	12.7
10. AVERAGE	0.57	11.2
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.83	1.5
12. Urban Quality of Life: A. Presence of an Urban Setting	0.40	0.0

Table 4-10 (Continued)

Wetland Functional Values	FVI	WVU
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.53	12.8
14. Noteworthiness	0.14	3.5

4.8 Paige Hill Road Marsh

This wetland complex is located along the west side of Paige Road, approximately one-half-mile south of the intersection of Paige Road and Stinson Road. This wetland is downstream of the Stinson Road Marsh wetland. The 27-acre wetland was divided into 5 areas for ease of investigation. The entire wetland is part of an old beaver flowage.

The uplands form an abrupt edge with the wetland in all areas but the extreme north end. ATV trails go around the western side, opposite the street.

Area 1

This wet meadow portion of the wetland (area 1) is dominated by bluejointgrass (*Calamagrostis canadensis*), averaging four feet in height. Also present are goldenrod (*Solidago altissima*), sensitive fern, silky dogwood (*Cornus amomum*), elderberry (*Sambucus canadensis*), and grey birch (*Betula populifolia*) occurring at the wetland margin. Closer to the open water of the actual "beaver pond," speckled alder (*Alnus rugosa*) and royal fern become dominant.

Area 2

The beaver impoundment portion of this wetland (area 2) is comprised primarily of emergent vegetation with some scrub shrub and open water intermixed. Apparently an apple (*Malus* sp.) orchard was at one time maintained along the western border. An old barbed wire fence is present and what seems to be a landscaped area.

The impoundment at this area of the wetland contains cinnamon fern, high-bush blueberry (*Vaccinium corymbosum*), blue joint, poison ivy (*Toxicodendron radicans*), *Carex lacustris*, and some purple loosestrife (*Lythrum salicaria*). The surrounding upland is upslope and evergreen consisting of mostly white pine (*Pinus strobus*). Red oak (*Quercus rubra*) is also mixed in. Cinnamon fern dominates the understory. An old rock wall is at the bottom of the slope.

Further west the wetland contains more dead snags, intermixed with scrub shrub and cattail (*Typha latifolia*) marsh. Wetland vegetation in this area includes red maple,

steplebush (*Spiraea tomentosa*), speckled alder, maleberry (*Lyonia ligustrina*), high-bush blueberry, winterberry (*Ilex verticillata*), and cinnamon fern. The upland portion contains white pine, beech (*Fagus grandifolia*), red maple, hemlock (*Tsuga canadensis*.)

Area 3

The beaver impoundment further west (area 3) is mostly emergent marsh but includes areas dominated by scrub-shrub and forested wetland. This area, furthest upstream of the dam, was the last to be affected by the beaver activity.

Area 4 (Above beaver dam)

Vegetation in this area includes red maple, royal fern, high-bush blueberry, swamp dewberry (*Rubus hispidus*).

Area 5 (Area west of beaver dam)

Vegetation in this area includes jewelweed (*Impatiens capensis*), sensitive fern, royal fern, fringed sedge (*Carex crinita*), bearded sedge, hop sedge (*Carex lupulina*), wool grass (*Scirpus cyperinus*), and iris (*Iris* sp.). The tops of large rocks can be seen protruding from the water's surface, along with small upland islands. The water is approximately 6 inches deep and tan colored in this area.

At the impoundment's outlet, the stream channel is approximately 6 to 8 feet wide and a foot deep. Dense overhanging vegetation along the channel includes multiflora rose (*Rosa multiflora*), yellow birch (*Betula alleghaniensis*), silky dogwood, speckled alder, and red maple. Spotted joe-pye-weed is also common along the banks.

Two beaver dams and moose scat were observed during the field investigation.

The wetland is a cattail marsh with portions of open water that contains aquatic vegetation such as lily pads. With minimal elevation changes vegetation dominates and standing water depth change. Moving west the wetland integrates more with shrubs and snags. The north tip of the wetland is dominated by 4-foot high bluejoint grass.

According to the NRCS Soil Survey, wetland soils at this site are primarily Greenwood mucky peat.

The principal functions of this wetland, as reflected by its FVIs, are: ecological integrity, wetland wildlife habitat, educational potential, visual/aesthetic quality, flood control potential, sediment trapping (Part B), nutrient attenuation, and urban quality of life contribution (both for wildlife habitat and visual/aesthetic quality).

Table 4-11
Paige Hill Road Marsh (27.0 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.92	24.8
2. Wetland Wildlife Habitat	0.89	24.1
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.65	4.6
5. Visual Aesthetic Quality	0.76	6.1
6. Water-based Recreation	0.00	0.0
7. Flood Control Potential	0.90	24.3
8. Ground Water Use Potential	0.40	10.8
9. Sediment Trapping: Part A	0.30	8.1
9. Sediment Trapping: Part B	0.74	20.0
9. AVERAGE	0.52	14.1
10. Nutrient Attenuation: Part A	0.20	5.4
10. Nutrient Attenuation: Part B	0.74	20.0
10. AVERAGE	0.47	12.7
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.00	0.0
12. Urban Quality of Life: A. Presence of an Urban Setting	0.20	13.5
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.80	21.6
12. Urban Quality of Life: C. Educational Opportunity	0.50	3.5
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.82	6.6
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.53	14.2
14. Noteworthiness	0.14	3.9

4.9 Stinson Road Marsh

This emergent marsh is located to the west of Stinson Road near its intersection with Paige Hill Road in the northwest portion of Goffstown. The wetland connects via an unnamed stream to the Paige Hill Road Marsh, approximately 0.5 miles to the southeast.

This predominately cattail marsh is fragmented by areas of open water with areas of lily pads (*Nymphaea* sp.) and contains a fringe of scrub-shrub wetland primarily along its eastern margin. Small shrubs, mostly stepple-bush (*Spiraea tomentosa*), are interspersed throughout the emergent portions of the wetland. The wooded fringe contains red maple, stepple-bush, and wool-grass. The upland creates an abrupt transition to the wetland. As the stream enters the site from the northwest, it flows through a wet meadow containing soft rush (*Juncus effusus*), wool grass, stepple-bush. The stream eventually becomes deeper and forms the pond-marsh

complex called here as Stinson Road Marsh. Channels created by beavers traveling throughout the marsh are readily apparent. Beavers are probably regulating the water level with a dam.

Wetland vegetation encountered along the fringe of this wetland includes high-bush blueberry (*Vaccinium corymbosum*), red maple, bluejointgrass (*Calamagrostis canadensis*), sphagnum moss, royal fern, cinnamon fern, and speckled alder (*Alnus rugosa*.)

The surrounding upland is primarily mixed softwood-hardwood forest containing white pine (*Pinus strobus*) and red oak (*Quercus rubra*) in the overstory, with bracken fern (*Pteridium aquilinum*), witch hazel (*Hamamelis virginiana*), white birch (*Betula papyrifera*), Canada mayflower (*Maianthemum canadense*), low-bush blueberry (*Vaccinium angustifolium*), and American chestnut (*Castanea dentata*) sprouts in the understory. Stands of eastern hemlock (*Tsuga canadensis*) also border the wetland in some areas. At the southwest end of the wetland, a rock wall separates the wetland from its upland edge where logging was occurring in August 2004.

Soils in the Stinson Road Marsh are characterized by NRCS as Greenwood mucky peat.

The principal functions for this wetland as reflected by its FVI scores are ecological integrity, wetland wildlife habitat, finfish habitat as found in lakes or ponds, visual/aesthetic quality, and nutrient attenuation.

Table 4-12
Stinson Road Marsh (16.1 acres)

Wetland Functional Value	FVI	WVU
1. Ecological Integrity	0.84	13.5
2. Wetland Wildlife Habitat	0.65	10.5
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.68	0.3
4. Educational Potential	0.55	2.2
5. Visual Aesthetic Quality	0.63	2.5
6. Water-based Recreation	0.51	0.3
7. Flood Control Potential	0.50	8.0
8. Ground Water Use Potential	0.40	6.4
9. Sediment Trapping: Part A	0.50	8.0
9. Sediment Trapping: Part B	0.42	6.8
9. AVERAGE	0.46	7.4
10. Nutrient Attenuation: Part A	0.30	4.8
10. Nutrient Attenuation: Part B	0.68	6.8
10. AVERAGE	0.49	5.8
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.00	0.0

Table 4-12 (Continued)

Wetland Functional Values	FVI	WVU
12. Urban Quality of Life: A. Presence of an Urban Setting	0.30	8.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.64	10.3
12. Urban Quality of Life: C. Educational Opportunity	0.53	2.1
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.82	3.3
12. Urban Quality of Life: E. Water-based Recreation	0.88	0.4
13. Historical Site Potential	0.28	4.4
14. Noteworthiness	0.14	2.3

4.10 Upper Black Brook (Northern Portion)

Black Brook is a 3rd order stream that drains from Great Meadow and Kimball Pond in Dunbarton, southeast through Goffstown and eventually outlets into the Merrimack River in Manchester. The Upper Black Brook Marsh is east of Black Brook Road, and north of Hoyt Road along the Goffstown/Dunbarton town line.

The surrounding land is dominated primarily by a mixed softwood forest. There is very little human activity or disturbance located within the vicinity of the wetland, except an area along the wetland's southwestern corner where recent residential development and an associated dirt road (with a small amount of wetland fill) was observed. An old gravel pit, most recently used as a landfill is within the vicinity of this residential area.

Black Brook approaches the marsh as a relatively high gradient stream that emerges into the broad, dominantly emergent and aquatic bed marsh. The marsh is staged into five main areas separated by beaver dams or narrowing channels. It has two large upland island inclusions, a rare and notable wildlife feature. This wetland also contains a large area of open water amounting to approximately 7 acres. Open water and emergent areas are intermingled throughout the system, providing excellent waterfowl habitat. Numerous unidentified waterfowl were observed from a distance within small pockets of open water surrounded by dense emergent vegetative cover. The adjacent upland appears to be well used by deer, moose and bear based on scat, tracks, and carcasses. Additional wildlife observed included belted king fishers, osprey, green frogs, painted turtles, and mallards.

Soils within this wetland complex are characterized by NRCS as Water (less than 40 acres) and Pondered Borohemists, both very poorly drained soils. Vegetation observed includes sedge, blue joint, wool-grass, pickerel weed, arrow arum, sphagnum, common winterberry, red maple, steeple bush, and high bush blueberry.

This wetland scores highly for its wetland wildlife habitat (for reasons described above), its educational potential, visual and aesthetic quality, and its resources for water-based recreation. However, access to this site is difficult. The relative isolation

of this system and lack of access may be a reason why this wetland scored so highly for some functions.

Table 4-13
Upper Black Brook (Northern Portion) (35.3 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.80	28.2
2. Wetland Wildlife Habitat	0.98	34.6
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.68	4.8
4. Educational Potential	0.71	4.6
5. Visual Aesthetic Quality	0.90	9.0
6. Water-based Recreation	0.70	4.9
7. Flood Control Potential	0.40	14.1
8. Ground Water Use Potential	0.83	29.4
9. Sediment Trapping: Part A	0.50	17.7
9. Sediment Trapping: Part B	0.42	14.8
9. AVERAGE	0.46	16.2
10. Nutrient Attenuation: Part A	0.30	10.6
10. Nutrient Attenuation: Part B	0.68	14.8
10. AVERAGE	0.49	12.7
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.83	1.4
12. Urban Quality of Life: A. Presence of an Urban Setting	0.30	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.38	13.2
14. Noteworthiness	0.29	10.1

4.11 Upper Black Brook (Southern Portion)

This wetland system is approximately 400 feet southeast of the northern portion of Black Brook Marsh. The surrounding land use is similar to the northern system, with the exception that there is no significant human activity within its vicinity.

The southern portion of the Upper Black Brook Marsh is a mix of upper perennial stream, beaver impounded areas of aquatic bed, emergent, scrub-shrub, and forested wetland. This wetland is dominantly riverine, whereas its northern counterpart is characteristically more palustrine. The upland habitat surrounding the wetland is a mixed mature forest. Just north of the northern end of the wetland is a narrow, fairly steep ravine. This area is of interest because it may contain potential den sites for burrowing animals.

Soils within this wetland complex are characterized by NRCS as Scarboro stony mucky loamy sand, and are very poorly drained. Vegetation observed includes speckled alder, lady fern, early meadow rue (*Thalictrum dioicum*), royal fern, cinnamon fern, peat moss, Virginia creeper (*Parthenocissus quinquefolia*), rough stemmed goldenrod, sensitive fern, red maple, silky dogwood, green ash, yellow birch, eastern white pine, and American elm.

An additional notable feature located approximately 200 feet south of this wetland is an old cellar hole. The area has many stonewalls as well. Ecological integrity, finfish habitat, and ground water use potential are all functions on which this system scored highly.

Table 4-14
Upper Black Brook (Southern Portion) (5.3 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	1.00	5.3
2. Wetland Wildlife Habitat	0.77	4.1
3. Finfish Habitat: Part A - Rivers and Streams	0.81	0.6
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.64	3.4
5. Visual Aesthetic Quality	0.79	1.6
6. Water-based Recreation	0.54	0.4
7. Flood Control Potential	0.70	3.7
8. Ground Water Use Potential	0.83	4.5
9. Sediment Trapping: Part A	0.50	2.7
9. Sediment Trapping: Part B	0.38	2.0
9. AVERAGE	0.44	2.3
10. Nutrient Attenuation: Part A	0.30	1.6
10. Nutrient Attenuation: Part B	0.55	2.0
10. AVERAGE	0.42	1.8
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.83	0.6
12. Urban Quality of Life: A. Presence of an Urban Setting	0.30	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.28	1.5
14. Noteworthiness	0.14	0.8

4.12 Lower Black Brook Marsh

Lower Black Brook Marsh is located to the northeast of Black Brook Road, approximately ¼ mile southeast of the southern portion of Upper Black Brook Marsh. Purgatory Brook enters the wetland from the north, while Black Brook enters from the northwest. A large, 160-foot stone dam exists at the wetlands southern end, which is visible from Black Brook Road.

The southern portion of this wetland is predominantly a riverine system with associated riparian scrub-shrub and floodplain forest. The northern portion is heavily beaver dammed, creating a large emergent marsh to the north, and a forested wetland to the south.

Along the Black Brook Road side of the wetland there is a moderate level of dense rural residential development. Some of the residences on the wetland side of Black Brook Road are built fairly close to the wetland, and have mowed lawns up to the wetland's edge. The eastern, northern, and northwestern portion of the wetland consists of an undisturbed mixed forest. Wildlife trails, deer scat, a green heron, belted king fisher, a wood duck box, snapping turtle, and an unidentified upland game bird was observed within the wetland. Additionally, a wood turtle (*Clemmys insculpta*) was discovered along the wetland's edge. This species is ranked as vulnerable in the State of NH.

Soils within this wetland system are characterized by NRCS as Pondered Borohemists, and Water (less than 40 acres), both consisting of very poorly drained soils. Vegetation observed includes sedge, blue joint, skunk-cabbage (*Symplocarpus foetidus*), pickerel weed, arrow arum, duckweed, poison ivy, cinnamon fern, sensitive fern, royal fern, wool-grass, early meadow rue, Virginia creeper, broad-leaf cattail, peat moss, spirea, common buttonbush (*Cephalanthus occidentalis*), high-bush blueberry, silky dogwood, arrow-wood speckled alder, serviceberry (*Amelanchier* sp.) gray birch, red maple, and eastern white pine.

The dam at the southern end of this wetland may be an important historical resource. The dam also allows this system to score very highly for its flood control potential. Additionally, this wetland scored well for its shoreline anchoring and dissipation of erosive forces, educational potential, visual aesthetic quality, and ground water use potential. Finally, its diversity of habitat types, proximity to upland habitat to the north and east, and the presence of a wood turtle score this system highly for wetland wildlife habitat.

Table 4-15
Lower Black Brook Marsh (31.9 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.83	26.6
2. Wetland Wildlife Habitat	0.98	31.4
3. Finfish Habitat: Part A - Rivers and Streams	0.70	3.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.70	3.2
5. Visual Aesthetic Quality	0.95	2.8
6. Water-based Recreation	0.58	2.5
7. Flood Control Potential	1.00	31.9
8. Ground Water Use Potential	0.83	26.6
9. Sediment Trapping: Part A	0.50	15.9
9. Sediment Trapping: Part B	0.70	22.3
9. AVERAGE	0.60	19.1
10. Nutrient Attenuation: Part A	0.50	15.9
10. Nutrient Attenuation: Part B	0.68	22.3
10. AVERAGE	0.59	19.1
11. Shoreline Anchoring and Dissipation of Erosive Forces	1.00	2.3
12. Urban Quality of Life: A. Presence of an Urban Setting	0.50	15.9
12. Urban Quality of Life: B. Wetland Wildlife Habitat	1.00	31.9
12. Urban Quality of Life: C. Educational Opportunity	0.63	2.8
12. Urban Quality of Life: D. Visual/Aesthetic Quality	1.00	3.0
12. Urban Quality of Life: E. Water-based Recreation	0.83	3.5
13. Historical Site Potential	0.75	23.9
14. Noteworthiness	0.29	9.1

4.13 Lower Harry Brook at Locust Hill Road

This wetland system is located along Harry Brook, south of where it crosses Elm Street, and north of where it crosses Henry Bridge Road. The wetland system is nestled between dense rural development to the west, north, and east, and a gravel pit to the south. Despite its location within an area of high human activity and disturbance, this system feels remarkably isolated and undisturbed.

Harry Brook is constricted to a single channel until the beginning of this wetland where it broadens into multiple braided channels under dense scrub-shrub and emergent vegetation. The streams have a high percentage of in-stream habitat features including snags, fast moving riffles, and shaded pools. A vibrant population of black nose dace (*Rhinichthys atratulus*) inhabit the stream, on which belted king fishers appeared to be feeding. An unidentified freshwater mussel shell was discovered along one of the stream's sandbars, which is indicative of good water quality. A number of abandoned stream channels (seasonally flooded) had large

populations of frogs and tadpoles. A painted turtle was observed as well. Deer tracks were observed throughout the wetland.

Soils within this wetland system are characterized by NRCS as Ippowam fine sandy loam, a poorly drained soil. However, soils observed were mucky, and soil conditions within the evaluation unit appeared to be very poorly drained. Vegetation observed includes sedge, blue joint, soft rush (*Juncus effusus*), purple loosestrife, sensitive fern, royal fern, wool-grass, early meadow rue, broad-leaf cattail, spirea, silky dogwood, arrow-wood, speckled alder, multiflora rose (*Rosa multiflora*), serviceberry, gray birch, red maple, American elm, and eastern white pine.

This wetland system is of particular value for its urban quality of life. It has a remarkable amount of habitat diversity, with highly interspersed vegetative cover types. Nutrient attenuation, flood control potential, and sediment trapping are all functions for which this system scores highly. It also has a relatively high historical site potential for a stone foundation bridge that crosses the system's outlet.

Table 4-16
Lower Harry Brook at Locust Hill Road (8.5 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.74	6.3
2. Wetland Wildlife Habitat	0.73	6.3
3. Finfish Habitat: Part A - Rivers and Streams	0.74	0.6
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.66	5.6
5. Visual Aesthetic Quality	0.79	2.4
6. Water-based Recreation	0.59	0.5
7. Flood Control Potential	1.00	8.5
8. Ground Water Use Potential	0.70	6.0
9. Sediment Trapping: Part A	0.75	6.4
9. Sediment Trapping: Part B	0.75	6.4
9. AVERAGE	0.75	6.4
10. Nutrient Attenuation: Part A	0.63	5.3
10. Nutrient Attenuation: Part B	0.72	6.4
10. AVERAGE	0.67	5.9
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.83	0.8
12. Urban Quality of Life: A. Presence of an Urban Setting	0.63	7.3
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.90	7.7
12. Urban Quality of Life: C. Educational Opportunity	0.75	6.4
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.82	2.5
12. Urban Quality of Life: E. Water-based Recreation	0.97	0.8
13. Historical Site Potential	0.53	4.5
14. Noteworthiness	0.29	2.4

4.14 Piscataquog River Floodplain

This wetland system is nestled between NH 13 (to the south) and NH 114 (to the north) along the Goffstown/New Boston town line. The wetland is located along the 4th order South Branch of the Piscataquog River, just west of the South Branch's juncture with the Piscataquog River.

Surrounding land use includes rural residential to the south and west, and agriculture to the north. The Piscataquog River becomes a 5th order stream at the juncture of the South Branch, and flows east-south-east to connect with the Merrimack River in Manchester. The South Branch lies in a wide floodplain valley north of North Mountain and south of the Kuncanowet Hills. This system has the largest drainage area of all the wetlands investigated, with comparatively high flow and discharge rates.

The majority of the western part of the wetland is seasonally flooded. Abandoned stream channels intertwine throughout the floodplain with stagnant, pooled water that support abundant populations of amphibians. The system, with its numerous surface water habitats (*e.g.*, pool/riffle riverine complex, isolated pools, and stagnant back water areas) is likely to support a diversity of benthic macroinvertebrates. This is a value resource for finfish, especially because the South Branch is considered Essential Fish Habitat by the National Marine Fisheries Service. Additional wildlife observed included various songbirds, and a white tail deer fawn.

Soils within this wetland system are characterized by NRCS as Rippowam fine sandy loam, a poorly drained soil. Vegetation observed includes sedge, reed canary grass (*Phalaris arundinacea*), purple loosestrife, sensitive fern, royal fern, deer tongue (*Dichanthelium clandestinum*), early meadow rue, yarrow, grape (*Vitis* sp.), poison ivy, Virginia creeper, joe-pieweed, barberry, bittersweet, broad-leaf cattail, spirea, speckled alder, mussclewood, red maple, willow (*Salix* sp.), American elm, basswood (*Tilia americana*), hemlock, and eastern white pine.

This wetland system scored particularly well for its stream finfish habitat. It is easily accessible and has numerous cover types, allowing it to score well for its educational potential. Finally, this wide floodplain system is noted for its high potential for flood control.

Table 4-17
Piscataquog River Floodplain (42.4 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.82	34.6
2. Wetland Wildlife Habitat	0.88	37.4
3. Finfish Habitat: Part A - Rivers and Streams	0.78	6.6
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0

Table 4-17 (Continued)

Wetland Functional Values	FVI	WVU
4. Educational Potential	0.72	3.6
5. Visual Aesthetic Quality	0.60	2.4
6. Water-based Recreation	0.63	5.3
7. Flood Control Potential	1.00	42.4
8. Ground Water Use Potential	0.70	29.7
9. Sediment Trapping: Part A	0.50	21.2
9. Sediment Trapping: Part B	0.44	18.7
9. AVERAGE	0.47	19.9
10. Nutrient Attenuation: Part A	0.38	15.9
10. Nutrient Attenuation: Part B	0.58	18.7
10. AVERAGE	0.48	17.3
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.37	1.3
12. Urban Quality of Life: A. Presence of an Urban Setting	0.38	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.28	11.7
14. Noteworthiness	0.29	12.1

4.15 Uncanoonuc Marsh

This large marsh complex is located northwest of Uncanoonuc Lake, north of the Uncanoonuc Mountains, south west of Benson Hill, and east of the Goffstown Reservoirs. Access to the marsh was most easily gained from the dirt road running along the northern side of Uncanoonuc Lake.

Surrounding land use is predominantly forested conservation land. Dense lakeside development is present along the shores of Uncanoonuc Lake, but does not extend beyond the immediate lakeshore. A single ATV trail runs along the marsh's southwestern perimeter, connecting to a well-developed trail system along the utility line right-of-way to the wetland's west.

Uncanoonuc Lake is dammed on both its eastern and western sides. The lake drains, for the most part, away from the wetland to the east. Groundwater from the lake supplies the eastern portion of the marsh, and the marsh drains northwest to the Goffstown Reservoirs. The marsh is an irregularly shaped, flat, and broad wetland dominated by emergent and scrub-shrub vegetation. The marsh is impounded on its western side by a large, 60-foot long beaver dam. A mature mixed conifer forest is adjacent to the wetlands eastern side. Large American beech (*Fagus grandifolia*) were observed within this forest, providing excellent wildlife forage. The thick conifer

canopy may be used as an important deer wintering area. Evidence of deer included scat, tracks, and many trails. Additionally, a small population of black gum was observed, and a dense population of rhododendron inhabits the southeastern corner of the marsh, and a majority of the marsh's eastern perimeter.

Soils within this wetland system are characterized by NRCS as Greenwood Mucky Peat, a very poorly drained soil. Vegetation observed includes sedge, peat moss, broad-leaf cattail, cinnamon fern, royal fern, sensitive fern, highbush blueberry, common winterberry, rhododendron, multiflora rose, elderberry, spirea, speckled alder, red maple, green ash, eastern white pine, and eastern hemlock.

This wetland, with the exception of dense development around Uncanoonuc Lake, has a remote characteristic dissimilar to many of the other systems investigated. Its close proximity to the undeveloped Uncanoonuc Mountains, and excellent wildlife habitat enhance this system's value for wildlife. It is the only system that is completely contained within existing conservation lands.

Table 4-18
Uncanoonuc Marsh (35.5 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.92	32.6
2. Wetland Wildlife Habitat	0.90	32.0
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.62	1.1
4. Educational Potential	0.72	2.2
5. Visual Aesthetic Quality	0.75	1.5
6. Water-based Recreation	0.51	0.9
7. Flood Control Potential	0.70	24.9
8. Ground Water Use Potential	0.53	18.9
9. Sediment Trapping: Part A	0.75	26.6
9. Sediment Trapping: Part B	0.43	15.3
9. AVERAGE	0.59	21.0
10. Nutrient Attenuation: Part A	0.63	22.2
10. Nutrient Attenuation: Part B	0.64	15.3
10. AVERAGE	0.63	18.7
11. Shoreline Anchoring and Dissipation of Erosive Forces	1.00	0.4
12. Urban Quality of Life: A. Presence of an Urban Setting	0.63	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.40	14.2
14. Noteworthiness	0.29	10.2

4.16 Shirley Hill Road Wetlands

These wetlands are located both north and south of Shirley Hill Road, approximately one-third mile east of the intersection of Shirley Hill Road and Wallace Road. This wetland is approximately 30 acres and contains multiple wetland classes from open water to forested swamp. For ease of investigation this wetland was divided into three portions: north and south sides of Shirley Hill Road as well as the most northern portion. The hydrological connection between the two parts is by a 6-foot culvert having laid-stone sides and a concrete top.

Stream flow in this wetland is southward and dammed by beavers. Old beaver sign is evident along the road edge. The water was very clear during the August 2004 investigation and the pond bottom is highly organic.

Portion South of Shirley Hill Road

The wetland area on the south side is an old beaver pond, with few snags remaining. Several vegetation classes are present, depending on the depth of water. Open water classes, scrub shrub and emergent classes are well interspersed. Large scrub-shrub and a red maple swamp occupy the margins of the pond. Vegetation becomes denser near the power lines, where the stream enters the pond. This area consists of emergent and scrub-swamp, except where the right-of-way access road goes through the site where it is primarily open water with small cobbles and sand. Communities of bur-reed (*Sparganium* spp.), buttonbush, steeple-bush (*Spiraea tomentosa*), and sedges form a matrix around the open water communities.

Wetland vegetation dominating the scrub-shrub fringe includes steeple-bush, purple loosestrife (*Lythrum salicaria*), red maple, maleberry (*Lyonia ligustrina*), wool-grass (*Scirpus cyperinus*), Bearded sedge, and buttonbush.

Under the power lines, vegetation includes speckled alder (*Alnus rugosa*), joe-pye-weed (*Eupatoriadelphus maculatum*), *Carex scoparia*, purple loosestrife, arrow arum, marsh fern (*Thelypteris thelypteroides*), bur-reed, spike rush (*Eleocharis* spp.), bluejoint (*Calamagrostis canadensis*), soft stem bulrush (*Scirpus validus*) and cattail.

Pondweed (*Potamogeton* spp.) and lily pads (*Nymphaea odorata*) provide some cover and shade over areas of deeper water. The eastern and northern sides of this portion of the marsh consist of cattail, but also contain steeple-bush and bur-reed. The southwest portion of this area is dominated by open water.

North Side of the Roadway

Immediately to the north of the roadway, wetland vegetation consists of the same species as above. Open water is predominate. In shallow areas, aquatic bed communities are present. Scrub-shrub forms the final layer until the upland is reached. The large shrubs occur in the seasonally flooded portions, and areas occasionally flooded during rain events, consist of previously mentioned shrubs and

arrow-wood (*Viburnum denatatum*), cinnamon fern, high-bush blueberry (*Vaccinium corymbosum*), and royal fern. Approximately 300-500 feet north larger scrub shrub and forested red maple communities emerge. The transition as you move up in elevation is a scrub shrub wetland with a dominance of speckled alder and eventually becomes a forested red maple wetland, with multiple narrow channels slithering through the 200-foot wide section of wetland. The stream channels range from 3 to 4 feet in width, stone and sand bottom with 2 inches of water to one larger channel (R2UB1) approximately 6 to 8 feet in width approximately 6- 8 inches deep with a stone bottom. A dirt road fragments the forest for a 10-foot section by a path. A 6-inch culvert with stone wing walls connects the two sections.

Wetland in the middle section includes the above mentioned and poison ivy, swamp dewberry, musclewood (*Carpinus caroliniana*), jack in the pulpit (*Arisaema triphyllum*), and spotted touch-me-not.

Northern-Most Portion of the Marsh

Water travels under the second road through a 24-inch metal culvert. This wetland is heavily vegetated except for a small portion near the entrance to the culvert. The wetland consists of PSS1H0gb, PSS1CH0nb, PEM1H0gb and PUB3H0b communities. Vegetation consists of royal fern, sensitive fern, red maple, speckled alder, high-bush blueberry, cinnamon fern and bur-reed.

The water is a little murk, tannin colored, with sediment such as dust and pollen on the water surface near areas that back up the water. The control length for this wetland is 50 feet or so.

**Table 4-19
Shirley Hill Road Wetlands (30.0 acres)**

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.67	20.1
2. Wetland Wildlife Habitat	0.77	23.0
3. Finfish Habitat: Part A - Rivers and Streams	0.64	2.6
3. Finfish Habitat: Part B - Ponds and Lakes	0.53	2.7
4. Educational Potential	0.76	7.6
5. Visual Aesthetic Quality	0.60	9.0
6. Water-based Recreation	0.70	6.3
7. Flood Control Potential	1.00	30.0
8. Ground Water Use Potential	1.00	30.0
9. Sediment Trapping: Part A	0.50	15.0
9. Sediment Trapping: Part B	0.70	21.0
9. AVERAGE	0.60	18.0

Wetland Functional Values	FVI	WVU
10. Nutrient Attenuation: Part A	0.65	19.5
10. Nutrient Attenuation: Part B	0.71	21.0
10. AVERAGE	0.68	20.2
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.67	1.1
12. Urban Quality of Life: A. Presence of an Urban Setting	0.65	15.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.90	27.0
12. Urban Quality of Life: C. Educational Opportunity	0.75	7.5
12. Urban Quality of Life: D. Visual/Aesthetic Quality	1.00	15.0
12. Urban Quality of Life: E. Water-based Recreation	0.80	7.2
13. Historical Site Potential	0.53	15.7
14. Noteworthiness	0.29	8.6

4.17 Perennial Tributary to Piscataquog and Associated Wetlands

This wetland is the only commercially zoned wetland investigated, with surrounding land dominated by commercial use to its east and south, NH 114 immediately to its west, and urban residential use to its north. The wetland is located between NH 114 and NH 114A, approximately 2000 feet south of their intersection.

The wetland complex consists primarily of open water, with fringe emergent and scrub-shrub vegetation. A concrete dam controls the wetland's water level, which has been beaver modified increasing the surface water elevation of the pond and expanding its fringe wetlands further upland. This has created excellent cover along the wetland's edge, which is likely used as an urban wildlife travel corridor. The wetland was stocked with large mouth bass, and is fished frequently. Wildlife observed included a pair of mallards, a great blue heron, and numerous green frogs.

Soils within this wetland system are characterized by NRCS as Scarboro Mucky Loamy Sand, a very poorly drained soil. Vegetation observed includes sedge, reed canary grass, purple loosestrife, broad leaf cattail, jewelweed, horsetail, multiflora rose, barberry, silky dogwood, speckled alder, and red maple.

This system is the most urban wetland studied, and surprisingly had among the highest scores for numerous functions and values. Flood control potential, sediment trapping, and nutrient attenuation, three very important functions especially within an urban environment, are all high scorers for this system. The system's urban quality of life is also a valuable function that scored very highly. Finally, the wetland has potential as a historic site.

Table 4-20
Perennial Tributary to Piscataquog and Associated Wetlands (11.1 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.70	7.8
2. Wetland Wildlife Habitat	0.68	7.6
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.38	2.6
4. Educational Potential	0.73	1.5
5. Visual Aesthetic Quality	0.74	5.9
6. Water-based Recreation	0.62	4.2
7. Flood Control Potential	1.00	11.1
8. Ground Water Use Potential	0.83	9.3
9. Sediment Trapping: Part A	0.60	6.7
9. Sediment Trapping: Part B	0.92	10.2
9. AVERAGE	0.76	8.5
10. Nutrient Attenuation: Part A	0.65	7.2
10. Nutrient Attenuation: Part B	0.89	10.2
10. AVERAGE	0.77	8.7
11. Shoreline Anchoring and Dissipation of Erosive Forces	1.00	0.6
12. Urban Quality of Life: A. Presence of an Urban Setting	0.65	7.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.80	8.9
12. Urban Quality of Life: C. Educational Opportunity	0.75	1.5
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.90	7.2
12. Urban Quality of Life: E. Water-based Recreation	0.77	5.3
13. Historical Site Potential	0.75	8.3
14. Noteworthiness	0.29	3.2

4.18 Paige Hill Swamp

This fifteen acre red maple and black gum swamp is located to the west of Paige Hill Road, approximately 800 feet north of the Winter Hill Road circle. Paige Hill Swamp is located over a small ridge to the wetland's east. Surrounding land use includes agriculture to the east, a dense rural residential area to the south, and recently forested scrubland immediately surrounding the wetland's western and northern sides. The swamp is situated atop a broad, shallow mountain valley. The majority of the wetland drains south to an intermittent stream, however, a portion of the wetland drains north to an unnamed tributary of Harry Brook.

The wetland provides habitat to deer and moose based on scat, tracks, and trails. Recent forestry activity has created excellent and ample browse. A large population of unidentified upland game birds was observed from a distance. Very notable is the population of black gum within the swamp. The swamp is not dominated by black gum, but a nice spread of black gum age classes was observed, indicating a healthy,

reproductively successful population. Additionally, a relatively large stand of Atlantic white cedar (*Chamaecyparis thyoides*) is present in the western portion of the swamp. This white cedar is significant because this wetland type is rare and in decline in the northeastern United States and is particularly sensitive to alterations or disturbance from human activity. Soils within this wetland system are characterized by NRCS as Chocorua Mucky Peat, a very poorly drained soil. Vegetation observed includes sedge, peat moss, gold thread, broadleaf cattail, wool-grass, blue joint, sensitive fern, cinnamon fern, royal fern, red raspberry, spirea, serviceberry, speckled alder, high bush blueberry, common winterberry, multiflora rose, red maple, black birch, eastern white pine, and yellow birch.

This swamp is buffered from human development and disturbance, as it is situated near the top of its watershed, well away from wetland degrading activities. This allowed the complex to score highly for its ecological integrity. The presence of a healthy black gum population contributes to this system's noteworthiness. The system also scored highly for its ground water use potential.

Table 4-21
Paige Hill Swamp (15.4 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.92	14.1
2. Wetland Wildlife Habitat	0.66	10.2
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.00	0.0
4. Educational Potential	0.61	9.3
5. Visual Aesthetic Quality	0.79	2.4
6. Water-based Recreation	0.00	0.0
7. Flood Control Potential	0.80	12.3
8. Ground Water Use Potential	0.83	12.9
9. Sediment Trapping: Part A	0.75	11.6
9. Sediment Trapping: Part B	0.37	5.7
9. AVERAGE	0.56	8.6
10. Nutrient Attenuation: Part A	0.63	9.6
10. Nutrient Attenuation: Part B	0.62	5.7
10. AVERAGE	0.62	7.7
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.00	0.0
12. Urban Quality of Life: A. Presence of an Urban Setting	0.63	7.7
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.54	8.3
12. Urban Quality of Life: C. Educational Opportunity	0.65	10.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.64	1.9
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.05	0.8
14. Noteworthiness	0.43	6.6

4.19 Juniper Drive Wetlands

The Juniper Drive Wetlands are located to the east of the cul-de-sac at the end of Juniper Drive. A recent residential development is built along both sides of Juniper Drive heading north, approaching the wetland, where residences continue on the west side of the road to the cul-de-sac. The western portion of the wetland is currently owned by the Town of Goffstown however, no conservation easement or other permanent protection exists in this area. The larger portion of the wetland to the east is surrounded by a mature mixed softwood forest.

Beaver activity has impounded open water throughout the majority of the wetland. The open water area was taken advantage of by a large flock of ducks, a great blue heron, a belted king fisher, frogs, tadpoles, and newts. The undisturbed, mature, mixed softwood abutting forest is used by deer as evidenced by scat.

Soils within this wetland system are characterized by NRCS as Greenwood Mucky Peat, a very poorly drained soil. Vegetation observed includes sedge, peat moss, bristley blackberry, swamp aster, soft rush, wool-grass, beggar-ticks, poison ivy, sensitive fern, cinnamon fern, spirea, high bush blueberry, maleberry, nannyberry, broad leaf cattail, red maple, gray birch, speckled alder, and eastern white pine.

This wetland is easily accessible with numerous wetland classes, scoring it well for its educational potential. Its use by waterfowl provides excellent potential for water-based recreation. Its proximity to a recent residential development scores this system well for its urban quality of life benefits.

Table 4-22
Juniper Drive Wetlands (9.7 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.83	8.1
2. Wetland Wildlife Habitat	0.84	8.2
3. Finfish Habitat: Part A – Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.70	1.1
4. Educational Potential	0.71	1.4
5. Visual Aesthetic Quality	0.79	1.6
6. Water-based Recreation	0.72	7.0
7. Flood Control Potential	1.00	9.7
8. Ground Water Use Potential	1.00	9.7
9. Sediment Trapping: Part A	0.30	2.9
9. Sediment Trapping: Part B	0.50	4.9
9. AVERAGE	0.40	3.9
10. Nutrient Attenuation: Part A	0.20	1.9
10. Nutrient Attenuation: Part B	0.68	4.9
10. AVERAGE	0.44	3.4

Table 4-22 (Continued)

Wetland Functional Values	FVI	WVU
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.83	0.4
12. Urban Quality of Life: A. Presence of an Urban Setting	0.20	5.4
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.82	8.0
12. Urban Quality of Life: C. Educational Opportunity	0.88	1.8
12. Urban Quality of Life: D. Visual/Aesthetic Quality	1.00	2.0
12. Urban Quality of Life: E. Water-based Recreation	0.94	9.1
13. Historical Site Potential	0.15	1.5
14. Noteworthiness	0.29	2.8

4.20 Bog Brook Tributary

The Bog Brook Tributary marsh is located along Goffstown's southwestern corner, south of Roby Road, and east of the Bedford Road/Christy Road intersection in New Boston. A woods trail off of Roby Road runs south to the wetland, providing the best access to the wetland.

Surrounding land is dominantly forested with some old field to the north, mixed forest to the east, and rural residential use to the west. Additional rural residential use lines Roby Road further to the north, and Bedford Road to the west. The marsh drains to the south into Bedford where the wetland is impounded by a dam. The wetland is supplied by upper perennial and intermittent streams that drain the southern hillsides of the Uncanoonuc Mountains. Additional hydrologic inputs enter the wetland from New Boston.

This wetland is dominated by aquatic bed habitats. Forested and scrub-shrub wetlands lie to the east of the large open water area, while emergent wetlands surround the majority of the aquatic bed and open water. Wildlife observed within and immediately around the wetland includes a large flock of unidentified ducks, a porcupine, and a large group of turkey (approximately 30). Deer scat was also observed around the wetland's perimeter. Recent evidence of bear activity was noted by an excavated ground wasp's nest.

Soils within this wetland system are characterized by NRCS as Pondered Borohemists and 0 to 3 percent Leicester-Walpole Complex, a very poorly drained soil. Vegetation observed includes sedge, peat moss, jewel weed, early meadow rue, swamp aster, gold thread, bristley blackberry, horsetail, arrowwood, hog peanut, broadleaf cattail, cinnamon fern, sensitive fern, royal fern, speckled alder, and red maple.

This wetland has a large area of open water habitat, with limited human disturbance. These features scored the system highly for its ecological integrity and its visual aesthetic quality. It also provides ground water use potential.

Table 4-23
Bog Brook Tributary (20.1 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.92	18.4
2. Wetland Wildlife Habitat	0.80	16.1
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.70	6.0
4. Educational Potential	0.62	4.9
5. Visual Aesthetic Quality	0.88	24.6
6. Water-based Recreation	0.62	5.3
7. Flood Control Potential	0.10	2.0
8. Ground Water Use Potential	1.00	20.1
9. Sediment Trapping: Part A	0.55	11.1
9. Sediment Trapping: Part B	0.37	7.4
9. AVERAGE	0.46	9.2
10. Nutrient Attenuation: Part A	0.33	6.5
10. Nutrient Attenuation: Part B	0.67	7.4
10. AVERAGE	0.50	7.0
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.83	0.3
12. Urban Quality of Life: A. Presence of an Urban Setting	0.33	0.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.00	0.0
12. Urban Quality of Life: C. Educational Opportunity	0.00	0.0
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.00	0.0
12. Urban Quality of Life: E. Water-based Recreation	0.00	0.0
13. Historical Site Potential	0.15	3.0
14. Noteworthiness	0.14	2.9

4.21 Hardy Brook Headwaters

The Hardy Brook Headwaters marsh is located along Goffstown's northeast corner. The wetland is north of Goffstown Road, and east of the East Dunbarton Road. Quimby Hill in Dunbarton is located just north of the wetland. The marsh originates in Dunbarton, flowing south into the towns of Goffstown and Hooksett.

Surrounding land use includes relatively dense rural residences to the west, south, and east. The Goffstown portion of the marsh may consist of only 20% of the larger marsh system. An estimated 40% is to the north in Dunbarton, while the remaining 40% is in Hooksett.

Beavers have strongly influenced the marsh's hydrology. A beaver dam at the marsh's outlet has created an open water with approximately 10% emergent vegetation. Emergent vegetation lines the open water's perimeter, with occasional

pockets of forested wetland. To the north where beaver flooding is less influential, highly interspersed emergent and unconsolidated bottom wetlands are present. Two otters were observed in this northern portion of the wetland. Other wildlife observed included Canadian geese, a belted king fisher, a great blue heron, and a cormorant.

Soils within this wetland system are characterized by NRCS as Pondered Borohemists, a very poorly drained soil. Vegetation observed includes sedge, blue joint, wool grass, spirea, speckled alder, high bush blueberry, gray birch, maleberry, nannyberry, and red maple.

This wetland is very large even though the only portion of it evaluated is in Goffstown. It provides excellent habitat for finfish, and ample opportunities for water-based recreation. Its proximity to areas of recent development received it a good score for providing urban quality of life functions. An old cellar hole within the proximity of the beaver pond's outlet scored the wetland highly for its historical site potential. Finally, its ground water use potential also scored very well.

Table 4-24
Hardy Brook Headwaters (24.0 acres)

Wetland Functional Values	FVI	WVU
1. Ecological Integrity	0.83	20.0
2. Wetland Wildlife Habitat	0.74	17.9
3. Finfish Habitat: Part A - Rivers and Streams	0.00	0.0
3. Finfish Habitat: Part B - Ponds and Lakes	0.83	15.0
4. Educational Potential	0.53	2.1
5. Visual Aesthetic Quality	0.77	36.4
6. Water-based Recreation	0.71	12.9
7. Flood Control Potential	0.70	16.8
8. Ground Water Use Potential	0.83	20.0
9. Sediment Trapping: Part A	0.30	7.2
9. Sediment Trapping: Part B	0.70	16.8
9. AVERAGE	0.50	12.0
10. Nutrient Attenuation: Part A	0.20	4.8
10. Nutrient Attenuation: Part B	0.73	16.8
10. AVERAGE	0.46	10.8
11. Shoreline Anchoring and Dissipation of Erosive Forces	0.83	0.8
12. Urban Quality of Life: A. Presence of an Urban Setting	0.20	18.0
12. Urban Quality of Life: B. Wetland Wildlife Habitat	0.72	17.3
12. Urban Quality of Life: C. Educational Opportunity	0.65	2.6
12. Urban Quality of Life: D. Visual/Aesthetic Quality	0.90	42.3
12. Urban Quality of Life: E. Water-based Recreation	0.91	16.3
13. Historical Site Potential	0.63	15.0
14. Noteworthiness	0.29	6.9

5

Discussion and Summary

The findings of this Prime Wetlands Study are summarized in two ways in this section.

In Section 5.1, we discuss the wetlands using the 14 Functional Values. For each functional value, we identify which wetlands are noteworthy for that particular function based on the total number of WVUs provided. In some communities, a particular function, say flood control, may be of special importance or interest to the public. Similarly, a community may decide that the educational potential of the wetlands within their town is of particular importance for providing “outdoor classrooms” for their middle-school’s science curriculum. These types of determinations are appropriate as the relative importance of one function over another is largely related to habitat management goals.

In Section 5.2, an overall summary is provided by comparing the 24 wetlands using an “average” FVI score and a “total” WVU score. The average FVI for a wetland is calculated as the mean of all 14 FVI scores. In most cases, this average provides a sense of how effectively the wetland performed all 14 functions (*i.e.*, representing an “average grade”). A low average may reflect that a wetland does not perform any of the functions at an exceptional level, although the presence of very high or very low individual FVI scores may go unnoticed unless accompanied by careful inspection or providing some sort of statistical measure of the spread of scores around the mean, like a standard deviation. In contrast, total WVUs is simply the sum of a wetland’s individual WVUs scores for all 14 functions. This latter metric gives a sense of the magnitude of a wetland’s contribution to the total ecological and societal needs of a community.

5.1 Comparisons of Functional Value

In the discussions below, highlights of the comparisons of the 24 candidate wetlands are described for each functional value. The most important wetlands for each functional value are in bold text for quick interpretation by the reader.

5.1.1 Ecological Integrity

Beaver Pond/Harry Brook Tributary Marsh, Gorham Brook Wetlands and Piscataquog River Floodplain had the three highest average WVUs (ranging between 35 and 41 WVUs) for Ecological Integrity (**Figure 5-1**). Four wetlands had WVUs for ecological integrity of less than 5: Upper Harry Brook and Northern Associated Wetlands, Upper Harry Brook and Southern Associated Wetlands, and Middle Harry Brook and Northern Associated Wetlands, and Middle Harry Brook and Middle Associated Wetlands.

5.1.2 Wetland Wildlife Habitat

The top three wetlands contributing the most WVUs for the wildlife habitat function (**Figure 5-2**) are also the three largest: **Gorham Brook Wetlands** (48.8 acres), **Beaver Pond/Harry Brook Tributary Marsh** (41.4 acres), and **Piscataquog River Floodplain** (42.4 acres). The relationship between size and WVUs is obvious for this function. Similarly, the three lowest scores were for the smallest wetlands: Upper Harry Brook and Southern Associated Wetlands (2.4 acres), Middle Harry Brook and Northern Associated Wetlands (3.6 acres), and Upper Black Brook Marsh (Southern portion) (5.3 acres).

5.1.3 Finfish Habitat

Two of the 24 candidate prime wetlands, **Hardy Brook Headwaters** (15 WVUs) and **Snook Road Swamp** (13.2 WVUs), provide a substantial amount of finfish habitat in the form of ponds or lakes (**Figure 5-3**). Two other wetlands, Bog Brook Tributary (6 WSVUs) and Upper Black Brook Marsh (northern portion) (4.8 WVUs), also a moderate amount of pond and lake habitat for finfish.

Relative to finfish habitat as found in rivers and streams, only two wetlands, Gorham Brook Wetlands (4.2 WVUs) and the Piscataquog River Floodplain (6.6 WVUs), provide an appreciable amount of habitat.

5.1.4 Educational Potential

By far the most important wetland for educational potential (**Figure 5-4**) was **Beaver Pond/Harry Brook Tributary Marsh**. This 41.4 acre wetland complex provides 25.8 WVUs) for this function and also contributed substantially to the wildlife habitat function. Its relatively easy public access contributed to this wetland's educational potential. Three wetlands, Paige Hill Swamp, Shirley Hill Road Wetlands, and Lower Harry Brook at Locust Hill Road all provided between 5 and 10 WVUs. The remaining candidate wetlands provide a very limited potential for educational value.

5.1.5 Visual/Aesthetic Quality

Both the **Hardy Brook Headwaters** (36.4 WVUs) and **Bog Brook Tributary** (24.6 WVUs) systems provide the highest number of WVUs among the 24 candidate wetlands for visual quality (**Figure 5-5**). The mix of several wetland classes contributes substantially to the high scores for these wetlands. (See also Photographs of these wetlands). With the exception of **Gorham Brook Wetlands** (15.1 WVUs), all the other wetlands provide less than 10 WVUs for this function.

5.1.6 Water-based Recreation

Snook Brook Wetlands with 16.4 WVUs ranks by the far the highest of all the candidate wetlands for water-based recreation (**Figure 5-6**). This wetland's use for hunting and its potential recreational value, if access were provided, contribute to its high FVI for this function. **Hardy Brook Headwaters** provides the second highest score with 12.9 WVUs. All of the remaining wetlands provide less than 7 WVUs for water-based recreation, with four providing no opportunities for these types of activities.

5.1.7 Flood Control Potential

Five of the candidate wetlands provide substantial flood control value (**Figure 5-7**): **Gorham Brook Wetlands** (43.9 WVUs), **Piscataquog River Floodplain** (42.4), **Beaver Pond/Harry Brook Tributary Marsh** (41.2 WVUs), **Lower Black Brook Marsh** (31.9 WVUs), and **Shirley Hill Road Wetlands** (30.0 WVUs). All of these wetlands scored high because of their large storage capacity (due to their size) and position low in the watershed. Eight of the candidate wetlands provide minimal flood control value primarily because of their small size (*e.g.*, Upper Harry Brook and Southern Associated Wetlands at 2.4 acres) or location high in the watershed (*e.g.*, Bog Brook Tributary).

5.1.8 Ground-Water Use Potential

Six of the candidate wetlands provide significant value (approx. 20 WVUs or more) for their ground-water use potential (**Figure 5-8**): **Gorham Brook Wetlands** (40.7 WVUs), **Shirley Hill Road Wetlands** (30.0 WVUs), **Piscataquog River Floodplain** (29.7 WVUs), **Upper Black Brook Marsh** (northern portion) (29.4 WVUs), **Lower Black Brook Marsh** (26.6 WVUs), and **Beaver Pond/Harry Brook Tributary Marsh** (22.1 WVUs). Their size and position over stratified-drift aquifers account for their high value when measured in WVUs.

5.1.9 Sediment Trapping

Both the **Gorham Brook Wetlands** (34.2 WVUs) and **Beaver Pond/Harry Brook Tributary Marsh** (26.9 WVUs) provide substantial value for their sediment trapping potential (**Figure 5-9**). These wetlands rank high for this function not only because of their size, but also for their location on the landscape, affording an opportunity to receive runoff from extensive areas of development surrounding them. The presence of persistent emergent vegetation also heightens their ability to trap sediments. In contrast, the smallest of the 24 wetlands provide little opportunity for sediment trapping because of their small size and the absence of development around them.

5.1.10 Nutrient Attenuation

The nutrient attenuation value of the candidate wetlands is highly correlated with the previous function, sediment trapping, since the same characteristics are important for both, *i.e.*, wetland size, presence of persistent vegetation and surrounding development. As a result, the graphs of total WVUs are almost identical for the two functions (compare **Figure 5-10** with **Figure 5-9**).

5.1.11 Shoreline Anchoring and Dissipation of Erosive Forces

Shoreline anchoring and dissipation of erosive waves or currents is an important function when the wetland immediately borders a large water body with a long fetch or a fast flowing stream. In addition, a high vegetation density in the wetland is also important to withstand these erosional forces. None of the 24 candidate wetlands (**Figure 5-11**), even the largest ones, provide any substantial value for this function since the length of their shoreline, rather than simply their acreage, is factored into the calculation of WVUs. The **Gorham Brook Wetlands**, although 48.8 acres in size and an FVI of 1.00, provide only 2.8 WVUs for this function. Similarly, **Lower Black Brook Marsh**, 31.9 acres in size and an FVI of 1.00, provides just 2.3 WVUs.

5.1.12 Urban Quality of Life

Only 10 wetland areas were scored on their ability to enhance the urban quality of life (**Figure 5-12**) since only wetlands in a developed setting can be evaluated. Five of the 10 wetlands, however, provide substantial WVUs, largely because of their wildlife habitat values. In the order of their importance for this function they are: **Hardy Brook Headwaters**, **Gorham Brook Wetlands**, **Paige Hill Swamp**, **Lower Black Brook Marsh**, and **Shirley Hill Road Wetlands**.

5.1.13 Historical Site Potential

The presence of historic features, like old stonewalls, dams, foundations, dumps, *etc.*, in association with the wetland, results in a high FVI for this function. Nine of the 24 candidate wetlands provide more than 10 WVUs for this function. **Gorham Brook Wetlands** has the highest score with 30.5 WVUs because of its size and the presence a man-made berm and old dam, while **Lower Black Brook Marsh** is second with 23.9 WVUs because of its size and the presence of both an historic dam and mill pond (See associated photographs).

5.1.14 Noteworthiness

Noteworthiness is the one function where the presence of one attribute or feature gives the wetland a high FVI. The presence of a rare species or exemplary plant community, a documented scientific research site, or a known archaeological site are all examples of features that will result in a high FVI. Of the 24 candidate wetlands, **Beaver Pond/Harry Brook Tributary Marsh** and **Gorham Brook Wetlands** rank the highest with 17.7 and 10.6 WVUs for this function, respectively. Beaver Pond/Harry Brook Tributary Marsh is not only the second largest wetland at 41.4 acres, but also ties with both the **Paige Hill Swamp** and **Snook Road Swamp** for the highest FVI at 0.43 for noteworthiness.

5.2 Comparison Among Wetlands

5.2.1 Average Functional Value

The average Functional Value Index for each of the 24 wetlands is shown in Figure 5.15. By inspection of the graph, it can be seen that seven wetlands had substantially higher averages than the others, *i.e.*, scores greater than 0.60. The **Gorham Brook Wetlands** had the highest average score of 0.76, followed closely by **Lower Black Brook Marsh** (0.72), and Shirley Hill Road Wetlands (0.71). The Gorham Brook Wetlands had individual FVI scores exceeding 0.80 for eight of the 14 Functional Values. The remainder of the wetlands, with one exception, had average FVIs near the mid range, *i.e.*, 0.40 to 0.50. The **Saunders Road Wetlands** had the lowest average FVI with 0.31. The absence of any finfish habitat, water-based recreation and shoreline protection value, as well as a minimal urban quality of life value, lowered the average FVI for this latter wetland.

5.2.2 Total Wetland Value Units

The total WVUs for each wetland are shown in **Figure 5.16**. Once again, **Gorham Brook Wetlands** had the highest total WVUs (400); not only because it was the largest wetland investigated (48.8 acres), but also because it had the highest average FVI (0.76). The **Hardy Brook Headwaters** wetland had the second highest total WVUs at nearly 300, even though at 24 acres this wetland is only half the size of the Gorham Brook Wetlands. Its average FVI was 0.63. Three other wetlands also had high total WVUs (*i.e.*, ≥ 250): **Beaver Pond/Harry Brook Marsh**, primarily because of its size; **Lower Black Brook Marsh** because of a high average FVI; and **Shirley Hill Road Wetlands** because of its high average FVI. **Upper Harry Brook and Southern Associated Wetlands** had the lowest total WVUs with only 14. This latter wetland is the smallest wetland evaluated at 2.4 acres and has only a moderate average FVI of 0.42. The **Saunders Road Wetland**, which has the lowest average FVI, also ranked in the lowest quartile (bottom 25 percent) relative to total WVUs.

6

Literature Cited

- Ammann, A.P. and A.L. Stone. 1991. Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire. NH Department of Environmental Services, Concord, NH. NHDES-WRD-1991-3.
- Bond, R.W., J.F. Handler, and G.S. Domain. 1981. Soil Survey of Hillsborough County, New Hampshire, Eastern Part. USDA, Soil Conservation Service. 152 pp plus maps.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Fish and Wildlife Service, FWSOBS-79/31.
- Medalie, L. and R.B. Moore. 1995. Ground-Water Resources in New Hampshire: Stratified Drift Aquifers. US Geological Survey, Bow, New Hampshire. 31 pp.