Oyster River Management Plan

2014

Submitted to the Department of Environmental Services

By the
Oyster River Local Advisory Committee
with Strafford Regional Planning Commission

Funding Source:

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

This plan was funded by a grant from the Local Source Water Protection Program at the New Hampshire Department of Environmental Services.

ACKNOWLEDGEMENTS

The Oyster River Local Advisory Committee (ORLAC) prepared the River Management Plan with the assistance from the Stafford Regional Planning Commission and the New Hampshire Department of Environmental Services Local Source Water Protection Grant Program. The plan was completed in 2014.

Members of the Oyster River Local Advisory Committee include:

John Wallace, Vice Chair	Barrington
Stephen Burns	Durham
Jim Colbert	Durham/UNH Water
Richard Horan, Treasurer	Durham
Jim Hornbeck	Durham
David Shay, Secretary	Lee
Tom Falk	Madbury
Eric Fiegenbaum, Chair	Madbury

The Oyster River Local Advisory Committee recognizes the professional contributions of Pierce Rigrod, Drinking Water Source Protection Program, and the stakeholders and partners that provided technical and editorial assistance in the development of this document.

Plan prepared by
Kyle Pimental, Senior Regional Planner
Liz Durfee, Regional Planner
Strafford Regional Planning Commission
150 Wakefield Street, Suite 12
Rochester, NH 03867
603-994-3500
www.strafford.org

Front Cover: Edge of the bog and wetland that make up the headwaters of the Oyster River, in the Samuel A. Tamposi Water Supply Reserve (SATWaSR)

Photo Credit: Dick Weyrick, Oyster River Watershed Association (2004)

MISSION STATEMENT

The Oyster River, the river corridor, and the greater Oyster River watershed have a number of important resource values for which the river was designated into the New Hampshire Rivers Management and Protection Program (RMPP). An advisory management plan is required by the state program and will be used to help guide river communities to achieve their goals in protecting and managing the valuable resources of the river.

The most important resource values to protect include:

Serving as the primary water supply for NH's state university, flagship campus, and the Town of Durham - The surface waters have been a primary source of potable water supply for the Town of Durham and the University of New Hampshire since 1935. Wells associated with the river's water resources contribute to municipal requirements, as well as the needs of individual landowners. The Oyster River's relatively high water quality is an important influence on the health of the Great Bay Estuary system.

The importance of pristine riparian floodplain along several portions of the river corridor - There are several portions of the river corridor that have pristine riparian floodplains – hundreds of acres in extent. Significant storm events have increased substantially over the past decade, resulting in costly infrastructure and property losses due to flooded and failed culverts. These floodplain areas are extremely important in providing flood storage, keeping losses lower than they would otherwise be.

Significant value for the purpose of education and scientific research - The core campus of the University of New Hampshire (Durham) lies adjacent to the Oyster River and the university owns over 200 acres of forested land along the river. These lands and waters, collectively known as the College Woods, are heavily used for teaching and research. College Woods is used by courses in the Department of Natural Resources and the Environment, Thompson School, Biology Program (General Ecology), and the Departments of Biological Sciences, English, and Art.

Numerous animal species - The Oyster River and its corridor support numerous animal and fish species, which are rare or vulnerable and have been listed as threatened, endangered, of special concern to the state including osprey, New England cottontail, and the American brook lamprey.

The collaborative effort between state agencies and municipalities in order to create a water supply protection reserve - The communities of Dover, Madbury, Durham, Lee, Portsmouth, and the University of New Hampshire obtain a portion of their drinking water from these rivers, and in an unprecedented move in New Hampshire, contributed funds or in-kind support to aid in the establishment of a water supply protection reserve on the Samuel A. Tamposi property.

The Oyster River Management Plan proposes a management approach focused on protecting and conserving the river's many resources, advocating for water quality and quantity to sustain aquatic and recreational uses, protecting riparian and aquatic habitat, and balancing the development of land and water uses for other public needs within the river corridor and watershed.

The Oyster River Local Advisory Committee (ORLAC) advocates for the implementation of the Plan and supports integration of its goals and strategies by the corridor communities in their planning initiatives and land use decisions.

The mission of the ORLAC is to carry out its duties and responsibilities established by the New Hampshire RMPP (NH RSA Chapter 483:8-a) to protect and maintain the resources, values, and characteristics of the Oyster River.

Table of Contents

List of Tables

List of Figures

Chapter I: Introduction

Background, History, and Accomplishments

Oyster River Watershed Association

Founded in 2000, the Oyster River Watershed Association is a 501(c)(3) nonprofit that seeks to protect, promote and enhance the ecological integrity and environmental quality of the Oyster River watershed through community participation and involvement. The Association holds monthly meetings and river walks, conducts outreach and educational activities throughout communities in the watershed, sponsors water quality monitoring through the NH Volunteer River Assessment Program on the Oyster River, and attends local meetings and provides occasional comment on projects of significance in the watershed. In 2001 the Association developed a watershed management plan for the Oyster River based on neighbor-to-neighbor collaboration.

Oyster River Watershed Association Riverwalks & Outreach Events

The Association has sponsored "Riverwalks" on roughly a monthly basis for a number of years. The general objective of these walks has been to learn about land uses and character of the vegetation along the streams, as well as potential water quality ramifications of situations that are observed. Most walks have consisted of walking a particular section of either the main stream or a tributary, but some have concentrated on particular issues of concern. Walks have been in held in all months of the year; winter walks have facilitated examination of stream sections that are very marshy. The walks are open to anyone who is interested.

Oyster River Watershed Association displays and volunteer water quality monitoring displays have been set up at many annual and special events in the watershed towns over the last decade:

- Durham Day
- Lee Country Fair
- Madbury Day
- Barrington Natural Heritage Day

Presentations:

- Durham Active Retirement Association
- UNH classes
- Durham - Great Bay Rotary

Oyster River Watershed Management Plan (June 2001)

In 2001, the Oyster River Watershed Association developed a management plan in order to create a platform for conversations regarding the long-term protection and management of the natural resources within the Oyster River watershed. This plan began with the Oyster River Watershed Association reaching out through a series of focused interviews to gather an understanding of the communities and the citizens living within them. The interviews evoked discussions that went much deeper than simply deciding on management techniques. It brought forth citizen awareness on many environmental issues and that regional approaches will be necessary to effectively plan and manage the river's resources. The concept of this management plan was to protect valuable resources as compared to a management or restoration effort and there would need to be a delicate balance between individual and community efforts whereby community intentions and limitations are respected.

Necessity of the River Management Plan

In June 2011, the Oyster River became one of 18 rivers designated by the Governor and Legislature of the State of New Hampshire as deserving of extra protection under the state's Rivers Management and Protection Program (RMPP). The Rivers Management and Protection Program identified a number of river-related values including a variety of natural, managed, cultural, recreational and other resource values. Some are significant at the local level; others are significant at either the state or national level. The resource values that qualified the Oyster River for designation included geology, wildlife, vegetation and natural communities, fish, water quality, natural flow, open space, impoundments, water withdrawals, historic and archeological, community river resources, boating, other recreation, public access, scenery, land use, and scientific resources.

The designation recognized the special qualities of the Oyster River and, under the provisions of RSA 483, the designation provides increased protection against the construction of new dams, damaging channel alterations, water quality impairment, and the siting of solid and hazardous waste facilities in the river corridor.

While designation of the Oyster River improved the protection and management of the river itself, ongoing efforts at the local level are needed to address the use and conservation of the river corridor and watershed. A growing recognition by local citizens and officials of the Oyster River's valuable contribution to the overall quality of life in their communities is evidenced by the twenty-two letters of support submitted in conjunction with the Oyster River designation into the RMPP.

The primary purpose of the Oyster River Management Plan is to incorporate the goals of the ORLAC, the corridor communities, and the river users; and to protect the rivers natural, recreational, cultural, and historic resources.

River Management Plan Purpose and Goals

The purpose of the Oyster River Management Plan is to:

1. Identify existing resources and current conditions
2. Identify priority management issues
3. Prioritize management issues and develop strategies to address them
4. Develop and implement an action plan to achieve the management priorities

The primary goal of the plan is to establish a unified framework from which river corridor communities and watershed communities can work together to achieve protection of the Oyster River and its resources. Priority management issues identified in the plan include the following:

1. Water Quality and Quantity Protection
2. Flood Management and Remediation
3. Land Protection - Resource and Habitat Conservation
4. River Corridor and Watershed Planning
5. Stewardship, Education and Outreach

Scope of the River Management Plan

The River Management Plan focuses on the river corridor, or the immediately adjoining land, and considers the character, resources, land use and development within the greater Oyster River watershed in order to comprehensively evaluate linkages between river and watershed resources and uses, and to assess any potential threats to the river.

The River Management Plan identifies short-term, intermediate and long-term goals for river and watershed protection along with strategies to address them. An Action Plan will organize the goals and strategies in a timeframe that allows for effective and timely implementation.

Plan Development Process and Participation

The ORLAC worked with the Strafford Regional Planning Commission to develop the Oyster River Management Plan. Tasks completed in development of the Plan included: mail surveys sent to property owners along the river; interviews with the Conservation Commissions in the Towns of Barrington, Durham, Lee and Madbury; key person interviews in the watershed; and public informational meetings for review and comment on the draft and final river management plans.

Public Participation Process

Mail-out survey: In early 2014, the Oyster River Local Advisory Committee, in partnership with the Strafford Regional Planning Commission, distributed a questionnaire to property owners on or near the river as part of their information gathering component for the development of the Oyster River Corridor Management Plan. A formal letter accompanied the survey to inform residents that the river corridor management plan, when completed, will identify short, intermediate, and long-term protection goals for the river and watershed, along with strategies to address them. The plan will be shared with towns along the corridor with recommendations as to how they might implement its goals and strategies. Out of the 512 surveys sent out, 114 responses were received; this constitutes a 22% response rate. The full report can be found in the Appendices.

Key interviews: There were six interviews conducted as part of the information gathering process. Interviewees included a member of the Oyster River Watershed Association, two members of the Lee Conservation Commission, President of Chinburg Properties, a Durham resident, and a staff member from the UNH Stormwater Center. Details of each interview can be found in the Appendices.

Strafford Regional Planning Commission also provided other forms of outreach, which included:

- Meeting with each conservation commission within the Oyster River corridor
- Meeting with the Oyster River Local Advisory Committee and Watershed Association
- Making available DRAFT copies of the Management Plan to the general public for review and comment on the Strafford Regional Planning website
- Submitting of the DRAFT Management Plan to NHDES for review and comment
- Posting on NHDES blog and newsletter
- Distributing of press release to notify the public of the Plan's completion
- Organizing a public meeting was held to introduce the Plan to the watershed

Chapter II: The Oyster River Designation

River Classifications

As part of its designation as a protected river, the Oyster River was divided into four segments based on the land use and environmental characteristics of the river and river corridor – two rural/community segments, one rural segment, and one community segment. Following is a detailed description of each segment and a map showing their locations along the river corridor.

Table 1: Location and Length of Designated River Segments

Segment Designation	Location	Segment Length (linear miles)
Rural/Community	Immediately downstream of the Hall Road bridge in Barrington, 4.6 miles to the upstream of Old Mill Road in Lee.	4.60
Rural	Immediately downstream of Old Mill Road in Lee, 3.07 miles to the upstream Route 155 crossing in Lee.	3.07
Rural/Community	Immediately downstream of the Route 155 crossing in Lee, 4.5 miles to the Oyster River Dam in Durham.	4.50
Community	Immediately downstream of the Oyster River Dam in Durham, 1.8 miles to the Mill Pond Dam in Durham.	1.80
Total Miles		**13.97**

[Source: Oyster River Nomination, 2010]

The total river length nominated for protection is 13.97 miles, from Hall Road near the headwaters in Barrington and runs through to the Mill Pond Dam in Durham. The total acreage of land within the Oyster River Corridor is 3,910 acres.

Rural/Community River Segment and Requirements

The River is designated as a rural/community segment immediately downstream of the Hall Road bridge in Barrington, 4.6 miles to the upstream of Old Mill Road in Lee; and immediately downstream of the Route 155 crossing in Lee, 4.5 miles to the Oyster River Dam in Durham.

According to RSA 483:7-a (New Hampshire Rivers Management and Protection Program) rural-community rivers are defined as:

"…those rivers or segments which flow through developed or populated areas of the state and which possess existing or potential community resource values such as those defined in official municipal plans or land use controls. Such rivers have mixed land uses in the corridor reflecting some combination of open space, agricultural, residential, commercial and industrial land uses. Such rivers are readily accessible by road or railroad and may include impoundments or diversions."

Rural River Segment and Requirements

The River is designated as a rural segment immediately downstream of Old Mill Road in Lee, 3.07 miles to the upstream Route 155 crossing in Lee.

According to RSA 483:7-a (New Hampshire Rivers Management and Protection Program) rural rivers are defined as:

"…those rivers or segments adjacent to lands which are partially or predominantly used for agriculture, forest management and dispersed or clustered residential development. Some instream structures may exist, including low dams, diversion works and other minor modifications."

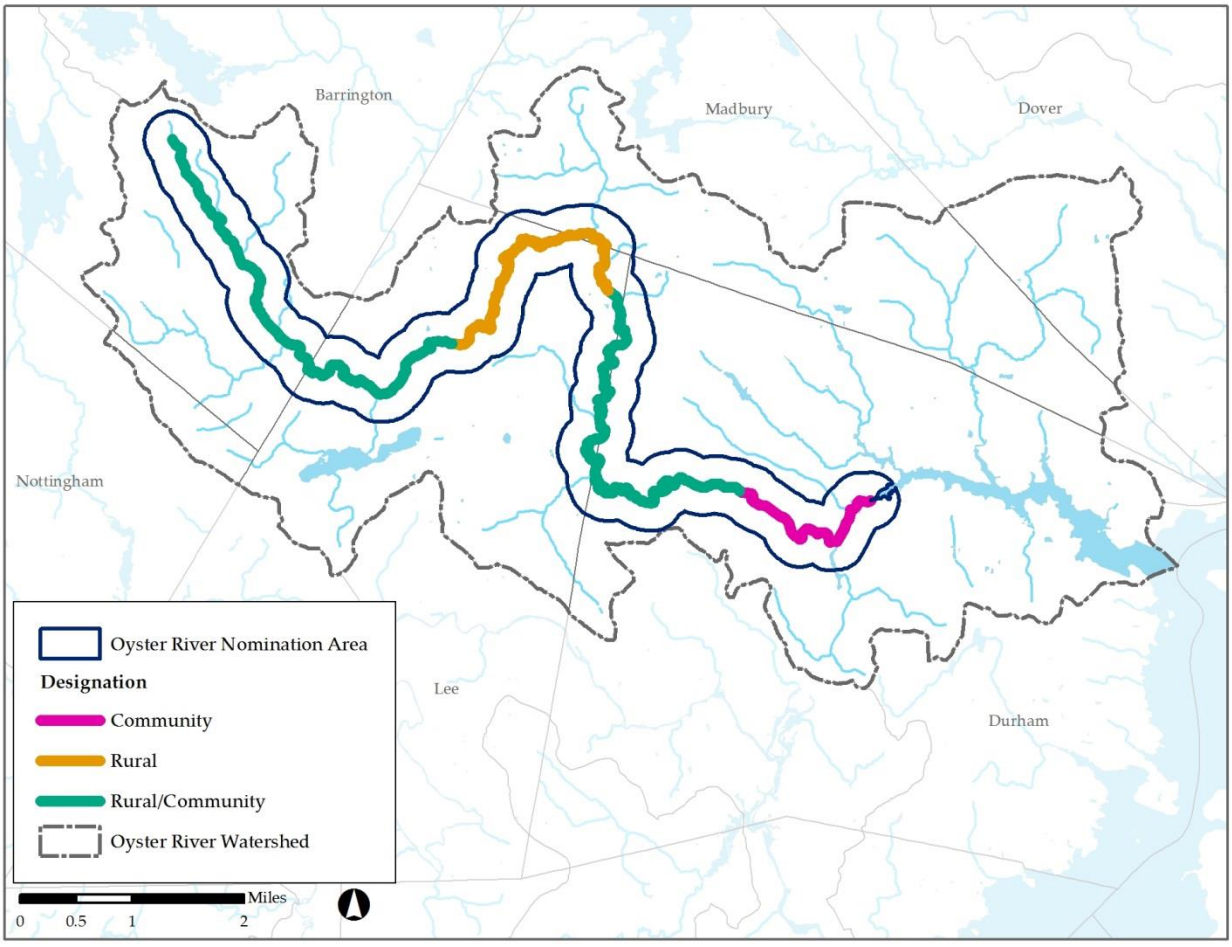
Community River Segment and Requirements

The River is designated as a community segment immediately downstream of the Oyster River Dam in Durham, 1.8 miles to the Mill Pond Dam in Durham.

According to RSA 483:7-a (New Hampshire Rivers Management and Protection Program) community rivers are defined as:

"…those rivers or segments which flow through developed or populated areas of the state and which possess existing or potential community resource values, such as those identified in official municipal plans or land use controls. Such rivers have mixed land uses in the corridor reflecting some combination of open space, agricultural, residential, commercial and industrial land uses. Such rivers are readily accessible by road or railroad, may include existing impoundments or diversions, or potential sites for new impoundments or diversions for hydropower, flood control or water supply purposes, and may include the urban centers of municipalities."

Figure 1: Oyster River Watershed and Designated Segments Map



[Source: Strafford Regional Planning Commission, 2014]

Shoreland Water Quality Protection Act (SWQPA)

The SWQPA (RSA 483-B), originally named the Comprehensive Shoreland Protection Act (CSPA) was enacted by the 1991 session of the Legislature. The act established minimum standards for the subdivision, use and development of the shorelands along the state's larger waterbodies. In April and July of 2008, the act was amended and several changes took effect including limitations on impervious surfaces, revised vegetation maintenance requirements and the establishment of a permit requirement for many, but not all, construction, excavation and filling activities within the protected shoreland. During the 2011 legislative session, the CSPA was renamed the Shoreland Water Quality Protection Act and changes were made to the vegetation requirements within the natural woodland and waterfront buffers, the impervious surface limitations and a new shoreland permit by notification process was established.

Waterbodies that fall under the jurisdiction of RSA 483-B include:

- Fourth order and greater streams and rivers
- Rivers or river segments designed under RSA 483, the Rivers Management and Protection Program
- Lakes and ponds greater than 10 acres in size
- Tidal waters subject to the ebb and flow of the tide

It is important to note that according to RSA 483-B, all rivers or river segments designated into the Rivers Management and Protection Program fall under the jurisdiction of the Shoreland Water Quality Protection Act. However, during the nomination of the Oyster River there were revisions made to House Bill 44, which exempted certain portions of the River from the provisions of the Act.

According to House Bill 44:

"…all 1st, 2nd, and 3rd order portions of the Oyster River shall be exempt from the comprehensive Shoreland protection act under RSA 483-B."

Due to this exemption, the segment of the River which falls under jurisdiction of the SWQPA begins at the junction of Dube Brook and the Oyster River in Madbury. It is at this location that the river becomes a 4th order stream and subject to the provisions of the SWQPA.

River Corridor and Watershed Characteristics

The Oyster River is a tributary of the Piscataqua River and part of the Great Bay Estuary in coastal New Hampshire. The river's headwaters begin in the town of Barrington and flow east through Lee, Madbury and Durham before flowing into the Great Bay. The freshwater and saltwater portions of the river are separated by the Mill Pond Dam in Durham. There is relatively little development along the river's length, with the riverbanks being primarily rural in nature.

River Corridor

As defined by RSA 483:4, the Oyster River corridor includes the river and the land area located within the distance of 1,320 feet (quarter mile) of the normal high water mark or to the landward extent of the 100-year floodplain as designated by the Federal Emergency Management Agency, whichever distance is larger. The Oyster River corridor is located within the communities of Barrington, Lee, Madbury, and Durham consisting of 3,910 acres of land and water.

A detailed summary of the river's corridor can be found in Table 2.

Table 2: River Corridor Acreage by Community

Community	Community Area (acres)	Corridor (acres)	Corridor Area (percentage)	Community in Corridor (percentage)
Barrington	31,117.3	880.0	22.5%	2.8%
Lee	12,927.3	1,548.0	39.6%	12.0%
Madbury	7,799.1	150.8	3.9%	1.9%
Durham	15,852.3	1,331.3	34.0%	8.4%
TOTAL	**67,696.0**	**3,910.1**	-	-

[Source: Strafford Regional Planning Commission, 2014]

Watershed

The Oyster River watershed spans just over 5 times the area of the river corridor and is approximately 31 square miles or 19,875 acres in size. It is one of the smallest watersheds located within the New Hampshire Coastal Basin. The drainage from the Oyster River and its watershed empties into the Great Bay, an estuarine system, which then empties into the Gulf of Maine. The Oyster River and all its tributaries in Barrington, Durham, Lee and Madbury are designated Class A streams. The river is used as a water supply for the University of New Hampshire and the Towns of Durham and Lee.

A detailed summary of the river's watershed can be found in Tables 3 and 4.

Table 3: Watershed Acreage by Community

Community	Community Area (acres)	Watershed (acres)	Watershed Area (percentage)	Community in Watershed (percentage)
Barrington	31,117.3	2,879.5	14.5%	9. 3%
Lee	12,927.3	4,759.7	23.9%	36.8%
Madbury	7,799.1	3,320.7	16.7%	42.6%
Durham	15,852.3	7,525.5	37.9%	47.5%
Nottingham	30,996.7	315.5	1.6%	1.0%
Dover	18,592.1	1,074.2	5.4%	5.8%
TOTAL	**117,284.8**	**19,875.1**	**100.0%**	-

[Source: Strafford Regional Planning Commission, 2014]

Table 4: 2013 Oyster River Stream Gage Flow Data

Number of Subwatersheds	7
Elevation Change Along River	380 feet
Median Daily Discharge	19.1 cfps
High Mean of Monthly Discharge	49.0 cfps (Mar.)
Low Mean of Monthly Discharge	3.74 cfps (Aug.)
Peak Stream-flow	193 cfps (Sep. 13)
Maximum Stream Gage Height	4.24 feet (Sep. 13)
Note: Discharge data was collected from 2013 Oyster River stream gage records; the mean of monthly discharge records were unavailable for Oct., Nov., and Dec.	

[Source: US Geological Survey Gage Station #01073000 Oyster River near Durham, NH]

Chapter III: Resource Identification

Identification and Description of River Resources

During the river nomination process, the Rivers Management and Protection Program identified a number of river-related values and characteristics that qualified the river for designation including a variety of natural, managed, cultural, recreational and other resource values. Some are significant at the local level; others are significant at either the state or national level.

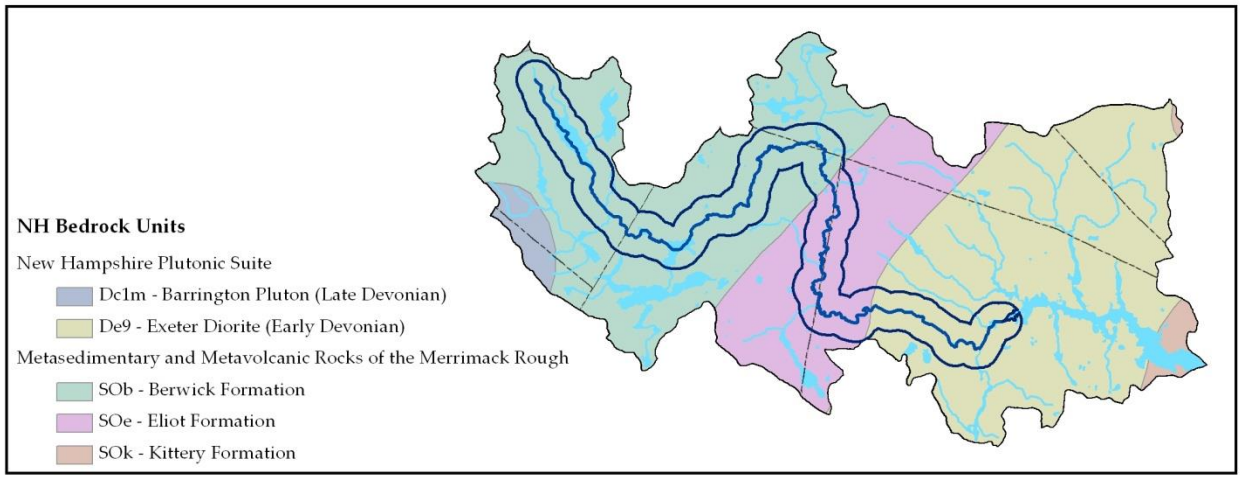
The resource values that qualified the Oyster River for designation include geology, wildlife, vegetation and natural communities, fish, water quality, natural flow, open space, impoundments, water withdrawals, historic and archeological, community river resources, boating, other recreation, public access, scenery, land use, land use controls, and scientific resources.

Natural Resources

Geologic Resources

Much of the Oyster River watershed is underlain by plutonic and metasedimentary rock formations. Plutonic, or igneous, formations include coarse-grained granitic and diorite rocks. Refer to Figure 2 for the distribution and description of these rock types within the watershed.

Figure 2: Geologic Formations of the Oyster River Watershed



[Source: NH GRANIT]

Similar to most of New Hampshire, the bedrock underlying the Oyster River corridor was covered by unconsolidated stratified drift deposits of till, unsorted glacial sediment, following the last glaciation. Stratified drift deposits consist of sand and gravel transported by Pleis glaciers and deposited in layers by meltwater streams.[1] These coarse-grained deposits are the basis for stratified-drift aquifers that are common and productive water sources in the watershed. These deposits also can provide significant sources of gravel and sand for construction purposes.

[1] Thomas J. Mack, Sean M. Taylor. Geohydrology and Water Quality of Stratified-Drift Aquifers in the Bellamy, Cocheco, and Salmon Falls River Basins, Southeastern New Hampshire. NHDES. 1992.

Aquifers

In New Hampshire, aquifers are classified into two major types: bedrock and stratified drift.

Bedrock Aquifers

Bedrock aquifers consist of fractured bedrock and ledge (highly fractured shallow bedrock). Interconnected features form fracture systems, which are highly variable in their occurrence, connectivity, and potential water yield. Groundwater may be stored within fractures and wells drilled into large fractures or extensive fracture systems may yield high amounts of groundwater. However, wells that do not hit a fractured area are likely to yield little, if any, water. One of the most reliable but often costly methods for locating fractures and fracture systems is by conducting geophysical mapping of the subsurface bedrock. Test wells are necessary to quantify potential water yield. The Oyster River watershed is underlain by bedrock, which provides sufficient yield for residential and some commercial uses.

Stratified Drift Aquifers

Stratified drift aquifers are composed of layers of sand and gravel deposited by meltwater coming from glaciers, not the glaciers themselves. These layers are partially or fully saturated by groundwater below the land surface. Water yield from stratified drift aquifers is highly affected by groundwater recharge from precipitation, snowmelt and atmospheric conditions (drought). These sand and gravel deposits are widespread in large river valleys and form broad, moderate to steep sloping hills on the landscape.

Stratified drift aquifers comprise nearly 8.5 percent of the total land area (13.3 percent of the total area) of the Oyster River watershed. A summary of the watershed's stratified drift aquifers can be found in Table 5.

Table 5: Acreage of Stratified Drift Aquifers by Watershed Community

Community	Watershed (acres)	Watershed Area (percentage)	Corridor (acres)	Corridor Area (percentage)
Barrington	324.3	12.2%	87.8	25.2%
Lee	1,069.1	40.4%	223.2	64.1%
Madbury	469.1	17.7%	0.0	0.0%
Durham	285.7	10.8%	37.0	10.6%
Nottingham	11.3	0.4%	0.0	0.0%
Dover	488.2	18.4%	0.0	0.0%
TOTAL	**2,647.7**	**100.0%**	**348.0**	**100.0%**

[Source: NH GRANIT]

Spruce Hole Aquifer

The Spruce Hole Aquifer is comprised of glacial deposits left behind during the recession of the last continental ice sheet that blanketed the region. Straddling Lee and Durham, it is well positioned between the Lamprey and Oyster Rivers. In the early 1970s the Town of Durham began actively seeking ways to protect the adjacent Spruce Hole unique kettle bog through land conservation. By 1989 the Town had established the Spruce Hole Conservation Area—approximately 35.6 acres of permanently protected land that sits atop the aquifer. Subsequently, studies of the aquifer by the USGS (Moore, 1990), the engineering firm Dufresne-Henry (1989), and UNH (Ballestero and Lee, 2000) identified the aquifer as a potential future public water supply.

In March 2012, the "Hydrological Investigation Town of Durham – University of New Hampshire Final Report," presented the findings of the long-term pumping test conducted by Emery & Garrett Groundwater, Inc., on the Spruce Hole Aquifer (NH DES Production Well DGD-PW2). In 2013 the Town purchased the adjacent 172-acre parcel, on which the Natural Resources Conservation Service holds a conservation easement, to further protect the aquifer and augment protected frontage along the Oyster River.

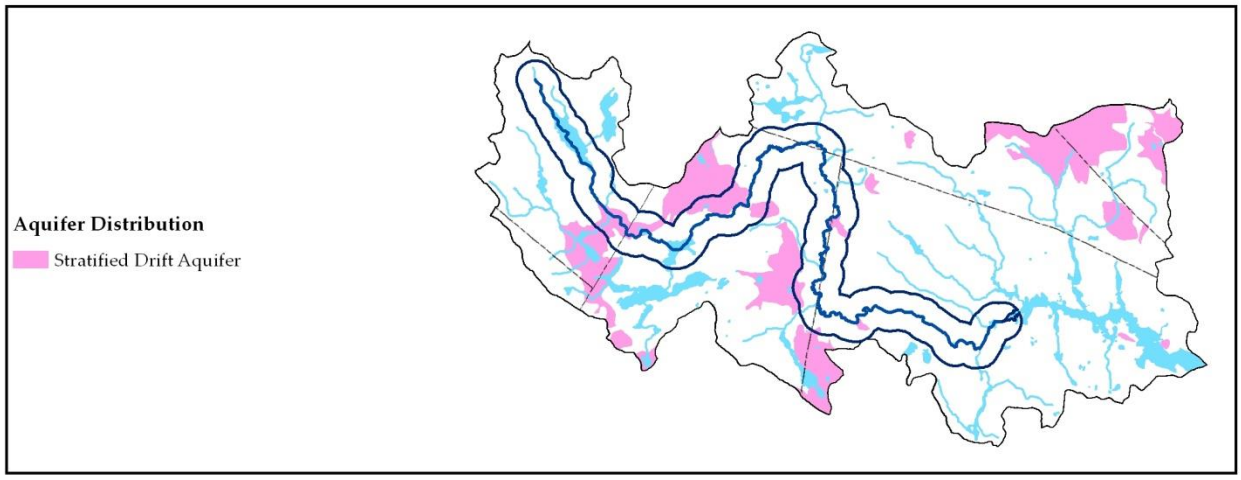
Spruce Hole Sphagnum-Heath Bog

The Spruce Hole Aquifer is also home to one of the few remaining undisturbed kettle-hole bogs in New England, the only such remaining in southeastern New Hampshire. The Spruce Hole Bog is an exceptional and environmentally sensitive formation created by the melting of a glacier. It was classified as a unique ecological area by the US National Park Service and in 1972 registered as a National Natural Landmark (NNL). Kettle hole bogs are distinctive ecosystems whose species composition can be greatly influenced by water table characteristics and chemical composition of incoming water. Recent development pressures and projected use of the Spruce Hole Aquifer as a public water supply for Durham required a study on the biological characteristics of the bog. Principle findings included that the bog is a perched system (separated by deposited organic material from the water table) and responds rapidly to rainfall, even though the underlying aquifer does not.[2]

On November 17, 2009 members of the public attended an unveiling ceremony of an official US Government NNL bronze plaque given to the Town of Durham by the National Parks Service (NPS), recognizing the Spruce Hole Bog as a unique geologic occurrence.

Refer to Figure 3 for the distribution of stratified drift aquifers throughout the entire watershed.

Figure 3: Distribution of Stratified Drift Aquifers in the Oyster River Watershed



[Source: NH GRANIT]

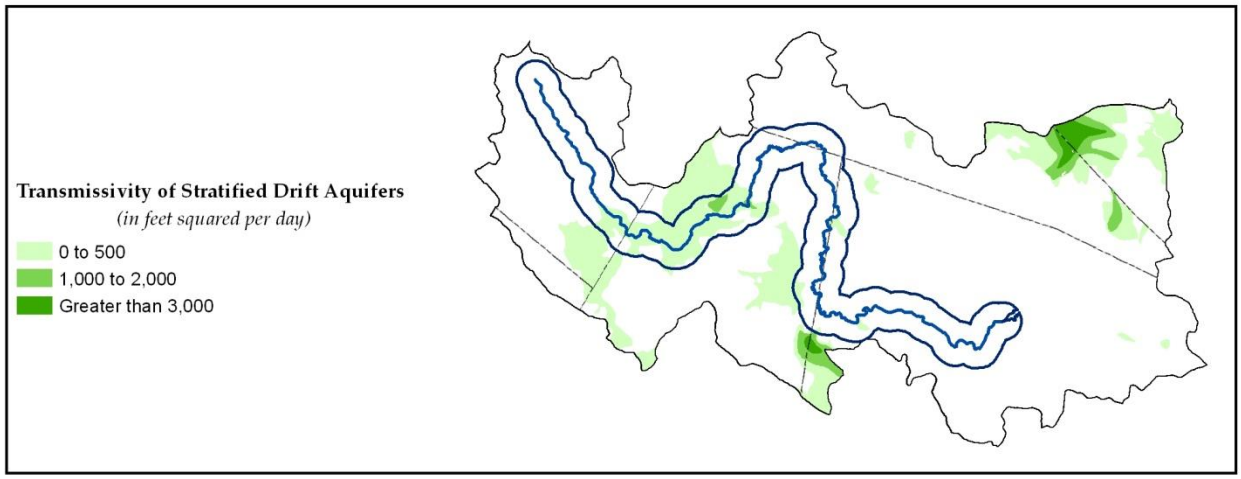
Transmissivity

Transmissivity of an aquifer is a measure of the quantity of water that can be transmitted horizontally. The term is typically used to determine the water that an aquifer can deliver to a pumping well. It can be calculated directly from the aquifer's average horizontal permeability and vertical saturated thickness. Transmissivity of stratified drift aquifers in the Oyster River watershed is estimated to be largely 0 to 500 feet squared per day, with isolated areas of 1,000 to 2,000 feet squared per day and a very small portion of greater than 3,000 feet squared per day (Spruce Hole Aquifer).

Refer to Figure 4 for the distribution and estimated transmissivity of stratified drift aquifers in the Oyster River watershed.

[2] Thomas P. Ballestero, Frank S. Birch, and Thomas Lee. Hydrology of the Spruce Hole Aquifer. UNH.

Figure 4: Estimated Transmissivity of the Stratified Drift Aquifers in the Oyster River Watershed



[Source: NH GRANIT]

Local Protections of Groundwater Resources

The importance of groundwater movement in replenishing water within the aquifers cannot be neglected. Some of this water may move in from adjacent topographic watershed divides, but most has filtered downward through overlying materials and laterally through the bedrock from rainfall and snowmelt.[3] Many areas within the watershed have been the focus of land conservation efforts focused on water resource protection.

Samuel A. Tamposi Water Supply Reserve

In 2001, the Town of Barrington completed one of the most considerable local and regional protection measures in managing water quality and quantity by permanently protecting 1400 acres of undeveloped land, identified as the Samuel A. Tamposi Water Supply Reserve (SATWaSR). The Reserve is home to the headwaters of the Oyster and Bellamy Rivers, which are both significantly important water supplies for the coastal communities. It includes a wide variety of habitats and populations of moose, bear, fox and fisher. Features also contain globally rare Atlantic white cedar swamp communities. The Town of Barrington owns the land that is protected by an easement held by the Society for the Protection of NH Forests. This large tract of conserved land makes it important for maintaining high water quality and stable flow volumes downstream.[4]

Sprucewood Forest

In 2013, the Town of Durham purchased a 171+-acre parcel along the Oyster River, known as Sprucewood Forest, to protect drinking water for the Town and the University of New Hampshire (UNH). This land acquisition project, which required funding from federal, state, and local sources, provides additional protection for the Spruce Hole Aquifer and ensures a clean water supply for almost 16,000 people on the municipal water system. In addition to protecting water, Sprucewood Forest provides excellent wildlife habitat and recreational opportunities. The property is of critical importance, as it contains suitable land for New England Cottontail, a state-listed endangered species. Sprucewood Forest is now part of the conservation and recreation corridor along the Oyster River, connecting over 2,000 acres of existing conserved land and trails.[5]

[3] Peter Thompson. University of New Hampshire. 2009

[4] Julia Peterson, Amanda Stone, and James Houle. *Protecting Water Resources and Managing Stormwater in New Hampshire*. UNH Cooperative Extension.

[5] "Conserved Land Helps Protect Oyster River - a Primary Source for UNH and Durham." The Source, 2013.

Another way to actively manage potential threats to groundwater, other than conservation efforts, is through groundwater reclassification. This is a process that involves both the local entity – a water supplier or municipality – and NHDES. The primary benefit of reclassification is increased safety of public water supply wells or aquifers in the area that has been reclassified. Limiting high-risk land uses and ensuring compliance with BMP rules are effective groundwater protection tools. While municipal zoning or site plan regulations may apply some protection during review of new land use activities, GAA/GA1 reclassification ensures that all land uses with the potential to contaminate groundwater follow simple BMPs and minimize the risk of releasing regulated substances. [6]

According to the NH Groundwater Protection Act: RSA 485-C, the four classes of groundwater are: GAA, GA1, GA2, and GB.

Table 6: Classes of Groundwater

Class	Local Inspection of Potential Contamination Sources (PCS)	Description/Comments
GAA	Yes	• Most protected areas • Includes groundwater flowing to public water supply wells (wellhead protection areas). • Prohibits six high risk land uses
GA1	Yes	• Local entities identify valuable groundwater resources they want to protect via management of potential contamination sources
GA2	No	• Includes high-yield stratified drift aquifers mapped by the USGS that are potentially valuable sources of drinking water
GB	No	• Includes all groundwater not in a higher classification. As in all classes, groundwater must meet drinking water quality standards

[Source: NHDES Source Water Protection Program, 2011]

Lee Well and Spruce Hole Aquifer

In 2004, the UNH/Durham water system worked with American Ground Trust and NHDES to reclassify the Wellhead Protection area for the Lee Five Corners gravel pack well to GAA status from its original status of GA2. Located in the Town of Lee at the [dead] end of Old Concord Road west of the Lee Five Corners intersection, this well is primarily a drinking water supply for the Town of Durham and the University of New Hampshire (UNH). The Town of Durham is entitled to the largest water volume from the well. The Town of Lee has access to a portion of the water from the well, but currently only has 6 full-time hook-ups and occasional fire suppression. The Lee Well and Spruce Hole Aquifer are combined; The Spruce Hole Aquifer drains to the Oyster River by way of Chesley Brook. The population served by the well varies seasonally depending on the enrollment at UNH. A minimum year-round base of 8,000 people in the Town of Durham is served. This rises to about 24,000 people when UNH is in session. The Town of Durham will maintain and update the Lee Fiver Corners Well Potential Contaminant Source (PCS) Inventory (and conduct inspections of PCSs) on behalf of both towns at least once every three years in order to maintain the GAA classification of the wellhead protection area.[7]

Lastly, local groundwater ordinances focus on the protection of aquifers as well as other locally important groundwater, such as wellhead protection areas. Many local ordinances provide an alternative to a strictly regulatory approach based solely on local use restrictions by including provisions for inspections, measurable performance standards for best management practices and stormwater treatment, and protection of selected groundwater resources that serve as drinking water supplies to ensure the necessary resources can be focused in these areas.[8]

A summary of the local groundwater protections within the Oyster River corridor can be found in Table 7.

[6] NH Department of Environmental Services. *The DES Guide to Groundwater Protection*. Revised October, 2008.
[7] NH Department of Environmental Services. *Ground Water Reclassification, Lee Five Corners Wellhead Protection Area*. American Ground Water Trust. November 10, 2003.
[8] NH Department of Environmental Services. Innovative Land Use Planning Techniques: A Handbook for Sustainable Development. Chapter 2.5 Protection of Groundwater and Surface Water Resources. October, 2008.

Table 7: Local Protections of Groundwater Resources by Corridor Community Identified in the PREPA.

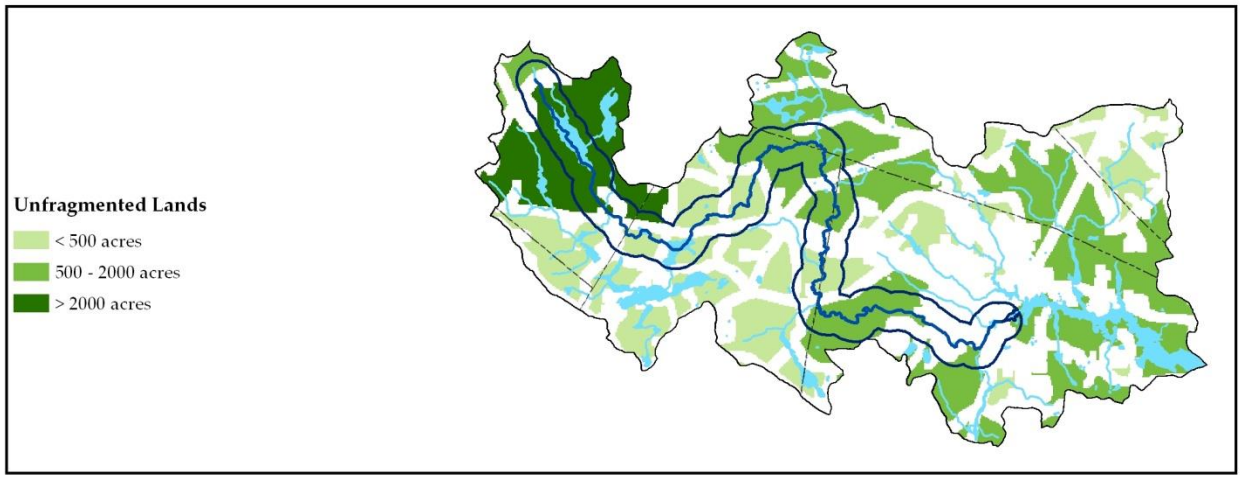
Community	Wellhead Protection Regulations	Aquifer Protection Regulations	Source Water Protection District	Prohibition on Large Ground Water Withdrawals & Export	Water Resource Management Plan in Master Plan
Barrington	Yes	Yes	No	No	No
Lee	No	Yes	No	No	Yes
Madbury	Yes	Yes	No	No	Yes
Durham*	No	Yes	No	No	No

[Source: Piscataqua Region Environmental Planning Assessment. PREP. March, 2010.]
*The Town of Durham and UNH have an Integrated Water Resource plan for the Oyster River; this is not part of the Town's Master Plan.

Wildlife Resources

The Oyster River corridor supports a diversity of habitats including: wetlands, forests, and open spaces that are home to a wide variety of wildlife. Especially important are the large tracts (>2000 acres) of unfragmented land that extend northwest in the watershed and into the Samuel A. Tamposi Water Reserve. As a whole, the Oyster River and adjacent riparian habitats are critical for the movement of wildlife species.

Figure 5: Unfragmented Lands



[Source: Wildlife Action Plan. US Fish & Wildlife Service, 2010.]

The following tables list species of mammals, macroinvertebrates, and birds that have been observed in the Oyster River and River corridor.

Table 8: Mammals in the Oyster River and River Corridor

Fisher	Beaver	Black Bear	Eastern Chipmunk	Mink
River Otter	Moose	Hairy-Tailed Mole	Virginia Opossum	Red Fox
Grey Squirrel	Ermine	Raccoon	Coyote	Red Squirrel
Snowshoe Hare	Striped Skunk	Muskrat	Meadow Vole	Little Brown Bat
Deer Mouse	Short-tailed Weasel	Pygmy Shrew	White-tailed Deer	Porcupine
New England Cottontail (E)	Eastern Cottontail	Woodchuck	White-footed Mouse	Grey Fox
Southern Flying Squirrel	Star-nosed Mole			

(E) = Endangered species defined by the NH Department of Fish and Game

[Source: Inventory of Natural, Agricultural, and Cultural Resources on the Tuckaway and Sheltering Rock Farms, Lee, NH 2009. Observed on River Walks and Wildlife Screenings.]

Table 9: Macroinvertebrates Observed in the Oyster River and River Corridor

Non-biting Midges	Pillbug	Caddisfly	Earthworms	Mayfly
Tube-maker Caddisflies	Dobsonflies	Dragonflies/Damselflies	Aquatic Amphipod	Winter Stoneflies
Snail	Black Fly	Common Stoneflies	Giant Water Bugs	Balloon Flies
Broad-shouldered Water Striders; Ripple Bug	Trumpet-net Caddisflies	Beetles	Darner	Net-spinning Caddisflies
Fingernet Caddisflies	Northern Caddisflies	Primitive Caddisflies	Angleworms	Alderflies
Crane Flies	Biting Midges	Flatworms		

[Source: David Neils, NH Department of Environmental Services. Stream Biomonitoring Report, 2007]

Table 10: Bird Species in the Oyster River and River Corridor

American Black Duck	Rufous Side Towhee	Cedar Waxwing	Mallard
Snowy Owl	Canada Goose	Gray Owl	Baltimore Oriole
Banded Pigeon	Ruby-throated Hummingbird	Warbling Vireo	Turkey Vulture
Song Sparrow	Common Nighthawk (E)	Golden-winged Warbler (C)	Swamp Sparrow
Blue Winged Warbler	Great Blue Heron	Cerulean Warbler (C)	Indigo Bunting
Whip-poor-will (C)	Northern Cardinal	Cooper's Hawk (C)	Grasshopper Sparrow
Pileated Woodpecker	Red-belly Woodpecker	Red-winged Blackbird	Red-tailed Hawk
American Woodcock (C)	Wild Turkey	American Goldfinch	Barn Owl
Mourning Dove	American Crow	Barred Owl	European Starling
Red-shouldered Hawk (C)	Hairy Woodpecker	Downy Woodpecker	Belted Kingfisher
Northern Harrier	Horned Lark	Pied-billed Grebe	Barn Swallow
Broad-winged Hawk	Brown Creeper	Gray Catbird	Black-capped Chickadee
Brown-headed Cowbird	Evening Grosbeak	Field Sparrow	Northern Flicker
House Wren	Dark-eyed Junco	American Kestrel	Killdeer
Ovenbird	Partridge	Pewee	Pheasant
Pileated Woodpecker	Timberdoodle	Tufted Titmouse	Eastern Towhee
Turkey	White-breasted Nuthatch	White-throated Sparrow	Winter Wren
Wood Thrush (C)	Common Yellowthroat	Yellow-bellied Sapsucker	Pine Warbler
Red-breasted Nuthatch	American Robin	Rose-breasted Grosbeak	Mockingbird
Bluebird	Osprey	Great Horned Owl	Eastern Phoebe
Yellow-rumped Warbler	Double-crested Cormorant	Ruffed Grouse	Tree Sparrow
Eastern Meadowlark	Screech Owl	Blue Jay	Wood Duck
Scarlet Tanager	House Sparrow	Chipping Sparrow	Common Raven

[Source: Inventory of Natural, Agricultural, and Cultural Resources on the Tuckaway and Sheltering Rock Farms, Lee, NH 2009. Observed on River Walks and Wildlife Screenings.]

NH Wildlife Action Plan (2010)

The New Hampshire Fish and Game Department collaborated with partners in the conservation community to create the state's first Wildlife Action Plan. The plan, which was mandated and funded by the federal government through the State Wildlife Grants program, provides New Hampshire decision-makers with important tools for restoring and maintaining critical habitats and populations of the state's species of conservation and management concern. It is a pro-active effort to define and implement a strategy that will help keep species off of rare species lists, in the process saving taxpayers millions of dollars.

The New Hampshire plan is a comprehensive wildlife conservation strategy that examines the health of wildlife. The plan prescribes specific actions to conserve wildlife and vital habitat before they become rarer and more costly to protect.

A general summary of the significant habitats by type within the Oyster River and River corridor can be found in Table 11.

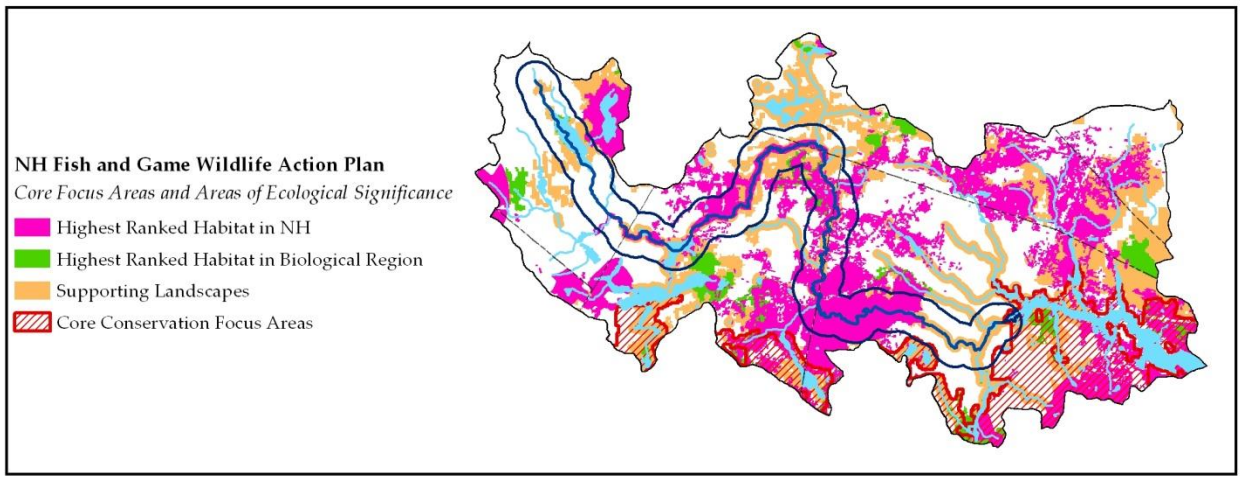
Table 11: Significant Habitats by Type

Habitat Type	Corridor Acres	Corridor Area (5)	Watershed Acres	Watershed Area (%)
Appalachian Oak Pine Forests	2,143.8	52.4	1,2134.4	61.3
Coastal Islands	0.0	0.0	0.9	0.0
Tidal Coastal Floodplain Forests	8.3	0.2	8.3	0.0
Grassland	584.2	14.3	3,158.0	15.9
Hemlock-Hardwood-Pine Forests	1,051.5	25.7	3,465.9	17.5
Marsh and Shrub Wetlands	264.1	6.5	678.7	3.4
Peatlands	33.3	0.8	228.7	1.2
Salt Marshes	2.3	0.1	125.8	0.6
TOTAL	**4,087.6**	**100.0**	**19,800.8**	**100.0**

Note: Some habitat types overlap.
[Source: Wildlife Action Plan. US Fish & Wildlife Service, 2010.]

The New Hampshire Wildlife Action Plan reports that the Oyster River contains several Core Focus Areas, highest ranked habitats in NH, highest ranked habitats in a biological region (as defined by the plan) and supporting landscapes. Refer to Figure 6 for a map of the Core Focus Areas and Highest Quality Habitat Areas.

Figure 6: Core Focus Areas and Highest Quality Habitat Areas



[Source: Wildlife Action Plan. US Fish & Wildlife Service, 2010.]

The Land Conservation Plan for New Hampshire's Coastal Watersheds (2007)

To advance the long-term protection of exceptional and irreplaceable natural, cultural, recreational and scenic resources, the State of New Hampshire, acting through the NH Coastal Program and the NH Estuaries Project, developed a comprehensive, science-based land conservation plan - The Land Conservation Plan for New Hampshire's Coastal Watersheds (2007). The overarching goal of the Plan is to focus conservation on those lands and waters that are most important for conserving living resources - native plants, animals, and natural communities - and water quality in the coastal watersheds. The Plan offers regional strategies for maintaining diverse wildlife habitat, abundant wetlands, clean water, productive forests, and outstanding recreational opportunities into the future.

The Plan identifies Conservation Focus Areas – areas where several resource values coincide and overlap, identifying locations with multiple conservation values and potentially higher priority for protection. Conservation Focus Areas are considered to be of exceptional significance for the protection of living resources and water quality in the coastal watersheds and consists of two parts: the Core Focus Area and Supporting Landscape Area. Core Focus Areas contain the essential natural resources for which the focus area was identified, with the boundary fitted to the real world of roads, forest edges, rivers and wetlands. Supporting Landscape Areas comprise the natural lands that buffer and sometimes link core areas and help to maintain habitat and ecological processes.

The Core Focus Areas and Supporting Landscape Areas identified in the Oyster River corridor and watershed include: Oyster River (Lee, Madbury, and Durham), Creek Pond Marsh (Barrington), LaRoche and Woodman Brooks (Durham), Johnson and Bunker Creeks (Durham and Dover), and Crommet and Lubberland Creeks (Durham).

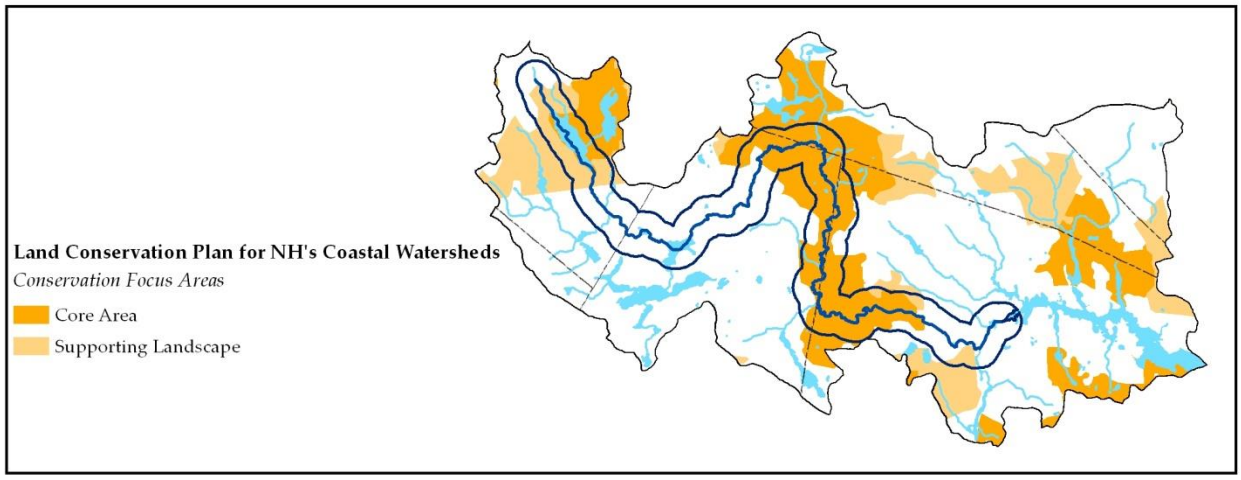
A summary the Core Focus Areas and Supporting Landscape Areas within the Oyster River corridor can be found in Table 12. These areas are shown in Figure 6.

Table 12: Core Focus Areas and Supporting Landscape Areas

Conservation Focus Areas	Corridor Acres	% Corridor	Watershed Acres	% Watershed
Core Focus Area				
Bellamy River			1.1	
Bumfagging Hill			4.1	0.1
Creek Pond Marsh	311.7	14.6	579.3	8.4
Crommet and Lubberland Creeks			417.4	6.1
Johnson and Bunker Creeks			747.6	10.9
LaRoche and Woodman Brooks			13.8	0.2
Oyster River Conservation Focus Area	1,423.6	66.8	2,649.1	38.5
Supporting Landscape Area				
Bellamy River			1.6	0.0
Creek Pond Marsh	311.7	14.6	866.1	12.6
Johnson and Bunker Creeks			800.4	11.6
LaRoche and Woodman Brooks	47.0	2.2	364.9	5.3
Lower Lamprey River			10.0	0.1
Oyster River	36.5	1.7	416.6	6.1
TOTAL	**2,130.5**	**100.0**	**6,872.0**	**100.0**

[Source: The Land Conservation Plan for New Hampshire's Coastal Watersheds, 2007.]

Figure 7: Conservation Focus Areas - Core Areas and Supporting Landscapes



[Source: The Land Conservation Plan for New Hampshire's Coastal Watersheds, 2007.]

Vegetation and Natural Ecological Communities

The river corridor for most of its length is either forest, open and shrub wetlands, or agricultural land; the latter dominated by hay fields. The exceptions are road/highway crossings, the commercial zone in the vicinity of the Lee traffic circle (Intersection of Routes 4 and 125), cultivated fields in the Mast Road (Route 155A) vicinity of Durham, and the residential development in the Mill Pond/ lower river vicinity in Durham. The forested portions are largely second growth woodlands that have grown following the decline of the earlier agricultural communities of the 1800's.

The undeveloped parts of the corridor are remarkably undisturbed and exhibit a pristine character that belies the nearby human influence. There is a large portion of the river where humans rarely visit and where natural processes take place with little human interference. To the extent possible the natural ecological communities will be described in terms of the habitat types that are identified in the New Hampshire Wildlife Action Plan and the Natural Communities of New Hampshire.

Table 13: Exemplary Natural Ecological Communities

Exemplary Natural Ecological Community	Location
Herbaceous Seepage March	Oyster River/College River – Durham
Hemlock – Beech – Oak – Pine Forest	College Woods – Durham
Red Maple Floodplain Forest	Oyster River/College River – Durham
High Salt Marsh	Bunker Creek - Durham

[Source: NH Natural Heritage Bureau, 2009]

Peatlands

The Oyster River origins are in Atlantic white-cedar swamps and peat bogs located in the Town of Barrington. The Barrington Atlantic white-cedar swamps fall into two types: 'seasonally flooded Atlantic white-cedar swamp' and 'Atlantic white-cedar -- yellow birch – pepperbush swamp'. Both types are considered rare and imperiled (ranked S2 by NH Heritage Bureau) in New Hampshire.[9] These peatlands are located mostly in the Samuel A. Tamposi Water Supply Reserve, which was acquired using funds raised by the Towns of Barrington, Lee, Madbury, Dover, Durham and UNH, as well as the New Hampshire Department of Environmental Services Water Supply Protection Program. In addition, there are peatland areas in the upper portion of Caldwell Brook, a major tributary of the Oyster River,

[9] Sperduto, D.D and N. Ritter. Atlantic White Cedar Wetlands of New Hampshire. NH Heritage Inventory, Department of Resources & Economic Development. 1994.

also protected via conservation easement. Some of the Caldwell Brook peatlands formerly supported Atlantic white-cedar, but cedar was eliminated by beaver impoundments. Some of the Tamposi cedar swamps have also been impacted by beaver flooding.[10]

Marsh and Shrub Wetlands

Much of the river edges, banks, and floodplains between the Tamposi Reserve and the Mill Pond in Durham are fringed with marsh and shrub wetlands. Marsh community types are represented by: 'tall graminoid emergent marsh', 'medium depth emergent marsh (with pickerel weed and bur-reed dominant)', 'cattail marsh', and 'aquatic bed' (mainly yellow water lilies), while shrub communities include 'speckled alder – silky dogwood – arrowwood alluvial thicket', 'meadowsweet alluvial thicket', and 'alluvial mixed shrub thicket'.[11] All of these wetlands are fairly common communities in NH (ranked S4-S5). Of special interest are the very large marsh, shrub, and forested wetland through which the river flows in the vicinity of the Lee traffic circle. This area encompasses more than 240 acres and includes examples of most of the communities cited above as well as some red maple floodplain forest.[12]

Floodplain and Other Wetland Forest

There are several forested areas in the corridor that serve flood plain functions, temporarily storing storm water and relieving flooding pressure downstream. These forests are generally dominated by red maple, and likely include the following community types: 'red maple – lake sedge swamp', 'red maple – sensitive fern swamp', and 'seasonally flooded red maple swamp'. Good examples of the rare (S2) 'red-maple – black ash – swamp saxifrage swamp' and 'red maple – elm – ladyfern silt forest' occur in College Woods within the Oyster River corridor.[13]

Prime Wetlands of Barrington

The Town of Barrington has designated Prime Wetlands, some of which are located within the Oyster River corridor and the watershed. The Barrington Zoning Ordinance, Article 9 Wetlands Protection District Overlay (WDO) requires that a minimum buffer of one hundred (100) feet be maintained from the edge of a designated Prime Wetland. The Planning Board may require a larger buffer around a Prime Wetland if an assessment of its functions indicates that such an increase is warranted to protect the roles the wetland serves that are of value to the public or the environment including, but not limited to, flood water storage, flood water conveyance, groundwater recharge and discharge, erosion control, wave attenuation, water quality protection, scenic and aesthetic use, food chain support, fisheries, wetland plant habitat, aquatic habitat and wildlife habitat.

Table 14: Designated Prime Wetlands in Barrington

	Total (Acres)	Corridor (Acres)	Corridor (%)	Watershed (Acres)	Watershed (%)
Prime Wetlands	1,863.8	101.7	5.46%	144.8	7.77%

[Source: Town of Barrington]

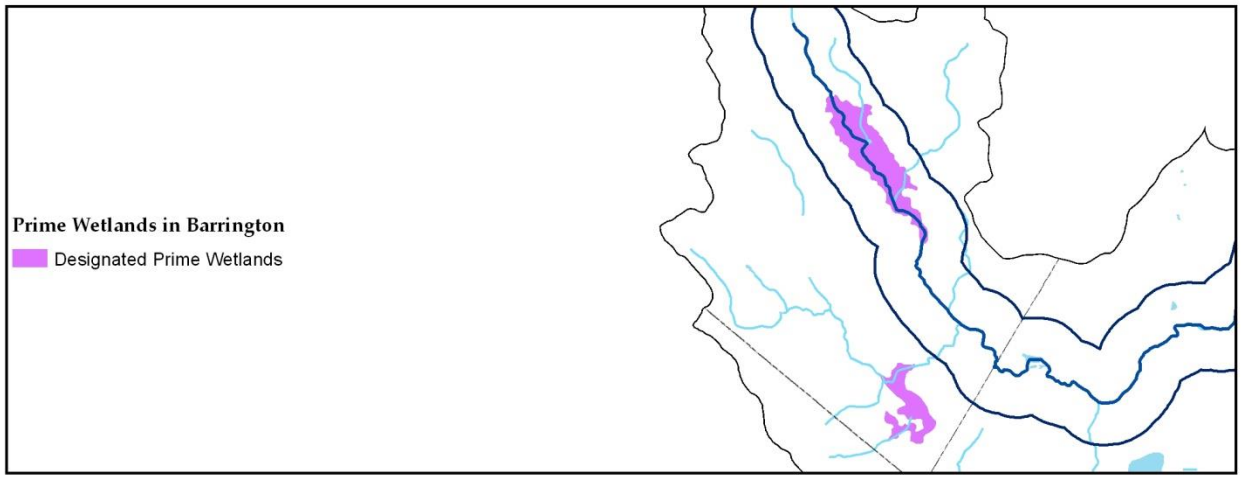
[10] Sperduto, D.D. and W.E. Nichols. Natural Communities of New Hampshire. NH Natural Heritage Bureau and the Nature Conservancy. Department of Resource & Economic Development. 2004

[11] Ibid

[12] Allan, David M. Wetlands of Lee. Lee Conservation Commission. Lee, NH. 1976

[13] Sperduto, D.D. and W.E. Nichols. Natural Communities of New Hampshire. NH Natural Heritage Bureau and the Nature Conservancy. Department of Resource & Economic Development. 2004

Figure 8: Prime wetlands in Barrington



[Source: Town of Barrington]

Upland Forest

The ¼ mile wide corridor that is the focus of the Oyster River nomination contains extensive upland forests. The majority of these are dominated by eastern white pine and a mixture of hardwoods. They occur on former agricultural lands (pastures and croplands) that were abandoned 30-140 years ago. Some of these forests are mature enough to be classified by the New Hampshire Heritage Bureau system, and they include: 'hemlock – beech – oak – pine forest', probably the most common type in the watershed, as well as dry red oak – white pine forest', 'mesic Appalachian oak – hickory forest', 'semi-rich Appalachian oak – sugar maple forest', among others. The University of New Hampshire College Woods includes some of the most unique forests in the seacoast region. Most of this forest is either 'hemlock – beech – oak – pine forest' or 'hemlock forest' both of which are not uncommon types, but contain unusually old and large eastern white pines and eastern hemlocks.[14] There are over 10 eastern white pine individuals that exceed 1 meter (3.3 feet) in diameter, and some that exceed 35 meters (120 feet) in height. Some of the pines likely exceed 300 years in age and several hemlocks exceed 200 yrs. The unusual properties of the matrix forest in the College Woods Natural Area are cited in Lyon's and Reiners' Natural Areas of New Hampshire Suitable for Ecological Research (1971) and Jorgensen's A Guide to New England's Landscape (1977).

Streams and Rivers

As reported in the table below, the Oyster River flows for 13.97 miles. This translates to the Oyster River representing 75.8% of the total streams and rivers within the corridor and 26.5% within the watershed. The main tributary streams and rivers comprise 9.1% within the corridor and 39.3% within the watershed. All other perennial and intermittent streams represent 15.1% within the corridor and 34.1% within the watershed.

[14] Sperduto, D.D. and W.E. Nichols. Natural Communities of New Hampshire. NH Natural Heritage Bureau and the Nature Conservancy. Department of Resource & Economic Development. 2004

Table 15: Miles of Oyster River and Tributary Streams in the River Corridor and Watershed

Resource	Type	Corridor (Miles)	Corridor (%)	Watershed (Miles)	Watershed (%)
Oyster River and River Segments	Rural	3.07	16.7%	3.07	5.8%
	Rural Community	9.1	49.4%	9.1	17.3%
	Community	1.8	9.8%	1.8	3.4%
Total Oyster River Miles		**13.97**	**75.8%**	**13.97**	**26.5%**
Beards Creek	Perennial	-	-	2.5	4.7%
Beaudette Brook	Perennial	-	-	0.95	1.8%
Bedford Brook	Perennial	-	-	0.40	0.8%
Bunker Creek	Perennial	-	-	0.33	0.6%
Caldwell Brook	Perennial (headwaters are intermittent)	0.74	4.0%	2.18	4.1%
Chelsey Brook	Perennial	0.30	1.6%	1.25	2.45
College Brook	Perennial	0.28	1.5%	1.89	3.6%
Dube Brook	Perennial	0.35	1.9%	1.30	2.5%
Gerrish Brook	Perennial	-	-	1.71	3.2%
Hamel Brook	Perennial	-	-	1.30	2.5%
Horsehide Brook	Perennial	-	-	0.56	1.1%
Johnson Creek	Perennial	-	-	3.29	6.3%
Littlehole Creek	Perennial	-	-	0.89	1.7%
Longmarsh Brook	Perennial	-	-	0.55	1.0%
Reservoir Brook	Perennial	-	-	1.54	2.9%
Smith Creek	Perennial	-	-	0.06	0.1%
Total Main Tributaries Streams and Rivers Miles		**1.67**	**9.1%**	**20.70**	**39.3%**
Other	All other perennial and intermittent streams	2.79	15.1%	17.97	34.1%
Total Other Perennial and Intermittent Streams Miles		**2.79**	**15.1%**	**17.97**	**34.1%**
Total Miles		**18.43**	**100.00%**	**52.64**	**100.0%**

[Source: National Hydrography Dataset, NH GRANIT]

Primary headwater streams - first order streams - comprise 79.7% of the total main tributary streams and rivers miles, which include all other perennial and intermittent stream miles but do not include the main stem of the Oyster River, within the watershed (See Table 16 and Figure 9). Headwater streams having a watershed area less than one square mile are considered primary headwater streams, and can be ephemeral, intermittent or perennial. The health of larger streams, rivers, and other surface waters in the watershed depend upon an intact primary headwater stream network. In particular, the stream network in the upper parts of the watershed greatly affects downstream water quality.

Table 16: Stream Order

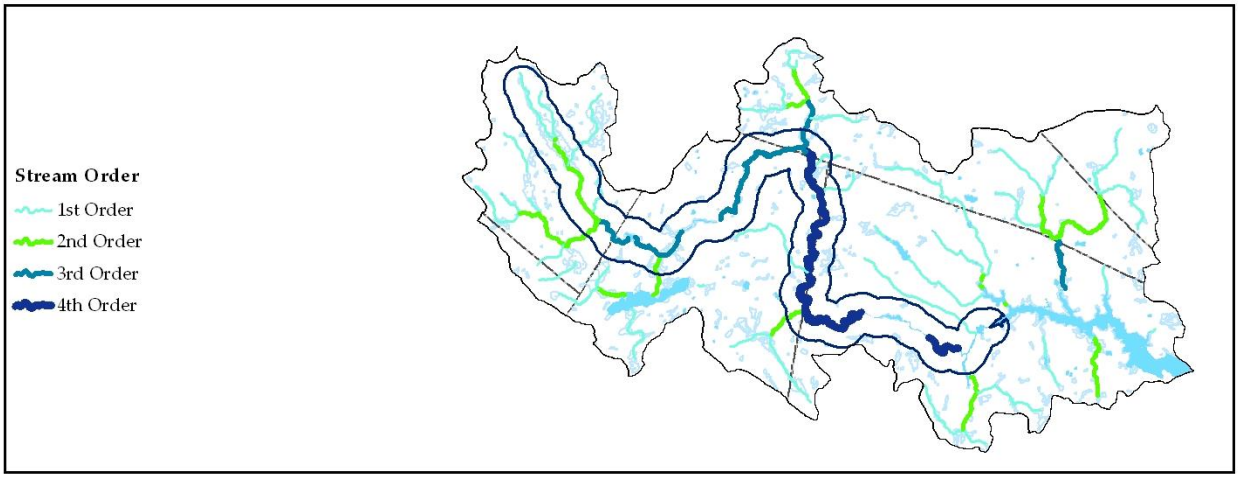
Stream Order	Total Length (miles)
First Order	30.3
Second Order	9.2
Third Order	5.5
Fourth Order	5.3
Total Miles	**50.3**

[Source: National Hydrography Dataset, NH GRANIT]

The importance and benefits provided by primary headwater streams include: reduction of sediment delivery downstream, reduction in nutrient loading (nitrogen and phosphorous), flood storage and control, and wildlife

habitat corridors and aquatic habitat. The economic reasons to protect and improve primary headwater streams include: protection of public drinking water sources; maintenance of recreational uses of lakes, ponds and rivers; minimizing damage to infrastructure (bridges, culverts, dams) and property; and maintaining channel morphology and land stability.

Figure 9: Stream Order within the Oyster River Watershed



[Source: National Hydrography Dataset, NH GRANIT]

Fishery

Although the Oyster River is naturally a warm water fishery, the river is managed by the NH Fish & Game as a put-and-take[15] cold water fishery that provides habitat for a number of resident warm and cold water fish species. Naturally occurring game species include largemouth bass and black crappie. Naturally occurring non-game species include bluegill, common shiner, brown bullhead, fallfish, and the common sucker. A full list of common freshwater species in the River can be found in Table 17.

Table 17: Common Freshwater Species in the River

Black Crappie	*Pomoxis nigromaculatus*	Creek Chubsucker	*Erimyzon oblongus*
Blacknose Dace	*Rhinichthys atratulus*	Fallfish	*Semotilus corporalis*
Bluegill	*Lepomis macrochirus*	Golden Shiner	*Notemigonus crysoleucas*
Brown Bullheads	*Ameiurus nebulosus*	Largemouth Bass	*Micropterus salmoides*
Chain Pickerel	*Esox niger*	Longnose Dace	*Rhinichthys cataractae*
Common Shiner	*Luxilus cornutus*	Pumpkinseed	*Lepomis gibbosus*
Common White Sucker	*Catostomus commersoni*	Yellow Perch	*Perca flavescens*
Brook Trout	*Salvelinus fontinalis*	Horn Pout	*Ameiurus nebulosus*

[Source: New Hampshire Fish and Game Department, 2009.]

A small number of brook trout are stocked in the Oyster River each spring. The fish ladder at the Mill Pond Dam in Durham is monitored by the marine division of New Hampshire Fish and Game Department (NHFGD). Sea lamprey adults have also been sporadically stocked above the water supply dam by researchers at UNH.The river herring returns to the Oyster River have historically been one of the highest yearly returns of all six rivers (Cocheco, Exeter, Oyster, Lamprey, Taylor, Winnicut) monitored by NHDES. However, according to a report released by NH Fish & Game, the Oyster River spawning run was the lowest since 1979, and is continuing to show indications of concern.

[15] The objectives of put-and-take management are to: 1) provide cold water angling opportunities in waterbodies where high angling pressure exists and/or habitat and environmental conditions exist that limit natural reproduction of trout; 2) assess water bodies to determine the appropriate number of trout to stock and to examine trout growth, survival, and angler catch rates.

In the spring of 2012, the Oyster River was one of six coastal rivers to be operated to facilitate the passage of river herring, American shad, and other diadromous fish over dams. According to the report titled, "New Hampshire's Marine Fisheries Investigation" estimated numbers of river herring using all coastal river fish ladders in 2012 increased by approximately 18% from 2011. Despite return numbers remaining stable over the past six years, NH's river herring return numbers are far below average for the past 25 years. High flows in 2005, 2006, and 2007 resulting in low numbers of adults utilizing fish ladders may be a contributor to these low returns. Alewives were the only species observed passing upstream in all the rivers except the Oyster River where blueback herring have consistently been the majority. However, in 2012, the run consisted of just 55.4% blueback herring.[16]

In 2012, the Oyster River had a return of 2,573 river herring representing the lowest return since 1979. The 2012 river herring return is far below the long-term average of 46,775 fish. As with the other rivers, high flows in 2005, 2006, and 2007 might have contributed to lower juvenile production resulting in low returns in subsequent years.

Table 18: Returning River Herring from 1972-2012

Year	Number of Blueback Herring	Year	Number of Blueback Herring	Year	Number of Blueback Herring	Year	Number of Blueback Herring
1972	N/a	1983	8,866	1994	91,974	2005	12,882
1973	N/a	1984	5,179	1995	82,895	2006	6,035
1974	N/a	1985	4,116	1996	82,362	2007	17,421
1975	N/a	1986	93,024	1997	57,920	2008	20,780
1976	11.777	1987	57,745	1998	85,116	2009	11,661
1977	359	1988	73,866	1999	88,063	2010	19,006
1978	419	1989	38,925	2000	70,873	2011	4,755
1979	496	1990	154,588	2001	66,989	2012	2,573
1980	2,921	1991	151,975	2002	58,179		
1981	5,099	1992	157,024	2003	51,536		
1982	6,563	1993	73,788	2004	52,934		

[Source: New Hampshire Fish & Game, 2013.]

Blueback herring, which arrive from the ocean later than alewives, constituted 55.4% of the run in this river (Table 1-3). In past years the river herring return to the Oyster River was comprised of solely blueback herring. This might be an indication that the preferred riverine spawning habitat of the blueback might be of poor quality, disappearing, or inaccessible from the Oyster River impoundment. Additional monitoring is needed to determine whether or not poor water quality is affecting the river herring run in this river.

The Oyster River contains the only known population of American brook lampreys in New Hampshire. The NHDES surveyed most of the watershed above the Durham water supply dam and produced a map of occupied brook lamprey habitat, which includes brook trout habitat (see Figure 10). A detailed study of bridle shiners in the Oyster River was conducted by Robert W. Harrison in the late 1940's. He published a number of papers describing the life history of bridle shiners based on observations of an abundant population in the Mill Pond impoundment. Surveys suggest that bridle shiners are no longer present in the Oyster River. The cause of extirpation is not clear, but sudden changes in water level behind the dam, pollution, siltation, nutrient loading, and introduced predators may have all been contributing factors.

[16] Cheri Patterson, Mike Dionne, Kevin Sullivan, Mike Dionne, Rebecca Heuss, Jessica Carloni, Robert Eckert, Liz Morrissey, and Bruce Smith. NHFGD. *Anadromous Fish Investigations*: Final Report. April 1, 2013

Table 19: Known Occurrences of Rare Fish Species and Exemplary Natural Communities

Species	Listing Status		Rank	
	Federal	State	State	Global
*American Brook Lamprey (*Lampetra appendix*)	-	E	S2	G4
**Bridled Shiner (*Notropis bifrentus*)	-	T	S3	G3

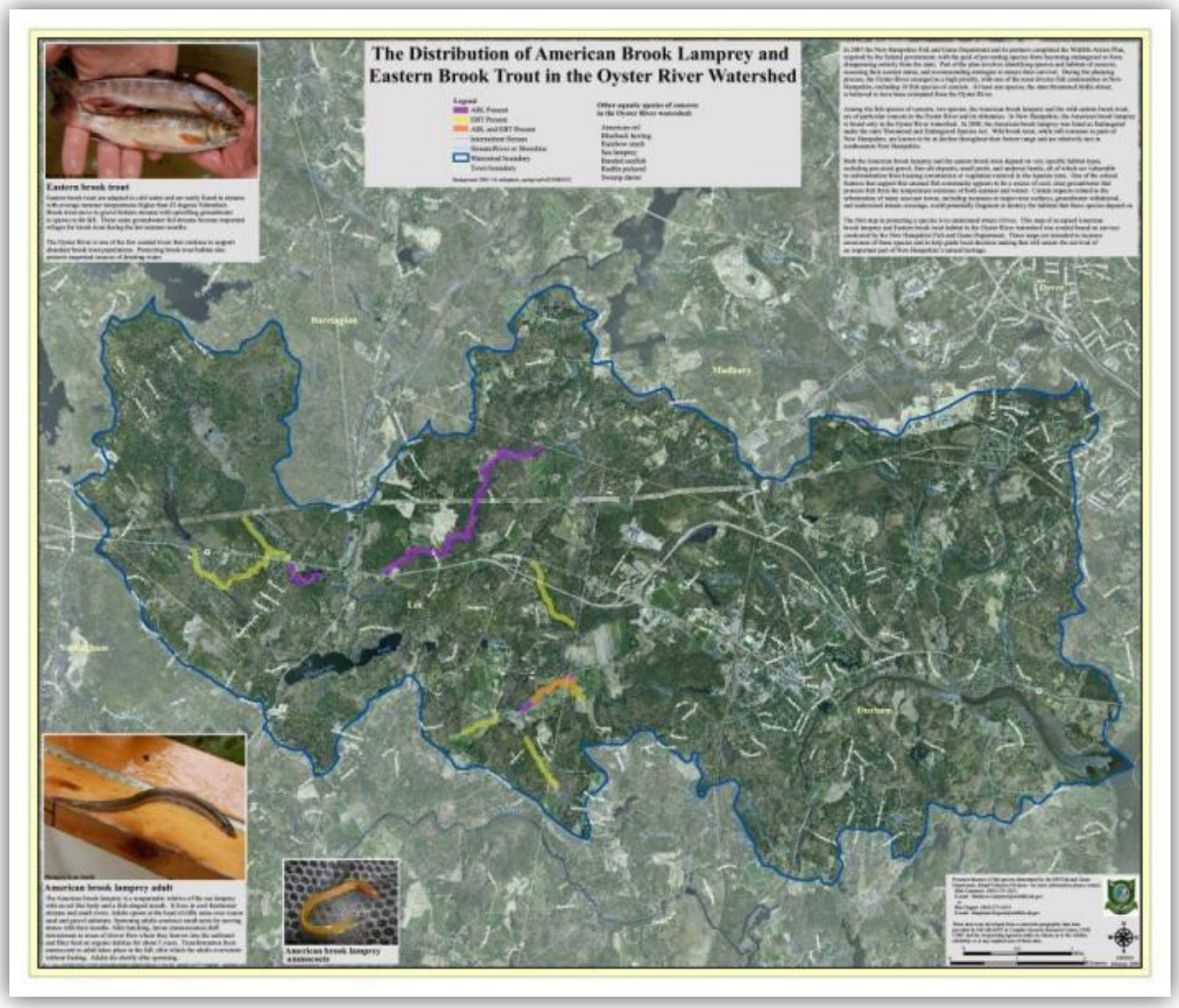
Listing Status
[E] = State Endangered Species [T] = State Threatened Species

State Rank	Global Rank
S2 = critically imperiled because of extreme rarity, especially vulnerable to extirpation from state. Typically 5 or fewer occurrences.	G3 = vulnerable, rare. Typically 21-100 occurrences.
S3 = vulnerable because rare or uncommon found in restricted range. Typically 6 to 20 occurrences.	G4 = apparently secure, uncommon not rare. Some cause for long-term concern. Usually more than 100 occurrences.

* The Oyster River contains the only documented population in New Hampshire.
** Appears to have been extirpated from the Oyster River Watershed.
[Source: New Hampshire Fish and Game Department, 2009.]

Although the Oyster River has no dams along its freshwater section (the Mill Pond Dam marks the tidal portion of the river), culverts for road crossings may act as barriers to fish passage particularly during periods of low flow due to inadequate size, shape, design, installation, and/or maintenance. Barriers may occur due to excessive culvert height, accelerated stream velocity, and other factors such as excess sediment deposition. Assessment of inadequate culverts would need to be included as part of a feasibility study for fish passage improvement. In some cases, correction of one or more inadequate culverts may be required to improve passage upstream.

Figure 10: Distribution of American Brook Lamprey and Eastern Brook Trout in Oyster River



[Source: NH Fish and Game]

Water Quality

Since 1991, the surface waters of New Hampshire have been classified by the state legislature (RSA-A:8) as either Class A or Class B.[17] Class A is the designation for waters for which the goal is to maintain the highest quality. For these waters the goal is to be potentially acceptable for water supply uses after adequate treatment. Class B is the second highest quality designation, where the goal is to be acceptable for fishing, swimming and other recreational purposes and, after adequate treatment, for use as water supplies. The Oyster River and all its tributaries in Barrington, Durham, Lee and Madbury from their sources to the crest of the Oyster River Reservoir dam are designated as Class A waters. All other portions of the Oyster River downstream of the Water Supply dam are designated as Class B.[18]

[17] NH DES Water Quality – Legislative History
[18] "Oyster River Nomination," Oyster River Watershed Association and Strafford Regional Planning Commission 2010.

Under purview of the New Hampshire Department of Environmental Services Volunteer River Assessment Program (VRAP), volunteers have monitored the Oyster River and its tributaries since 2001.[19] In 2014, the Oyster River Watershed Association prepared a report comparing VRAP data among sampling locations and across time for 11 years (2001-2011) and 21 sites along the main stem and tributaries of the Oyster River. Water quality measurements include dissolved oxygen (DO), temperature, turbidity, specific conductance, pH, E. coli, nitrogen, phosphorus, and macro invertebrates. The water quality at most sites on the main stem of the Oyster River and on its tributaries appears to be unimpaired or minimally impaired by human activity. Three tributaries (College Brook, Pettee Brook, and Wendys Brood) have conductances and nutrient levels typical of streams impacted by urbanization.[20] Refer to Chapter IV for a summary of this water quality data.

Although the Oyster River has relatively high water quality, there are existing impairments in the six assessment units (AUs) of the river. These include: slight water quality impairment for safe fish consumption due to mercury contamination in all AUs; severe impairments for DO and pH for aquatic life in four AUs; and impaired for E. coli in all segments except the Oyster River Reservoir. [21]

The significance of maintaining a high level of water quality in the Oyster River is evident in the use of the river for recreational purposes, education and scientific research, and as the primary water supply for UNH and the Town of Durham. The Oyster River's relatively high water quality is an important influence on the health of the Great Bay Estuary system, and the river and its floodplains support diverse natural communities and significant wildlife.

Natural Flow Characteristics

The Oyster River watershed is approximately 31 square miles and flows for 13.97 miles. From the headwaters west of Hall Road in Barrington 10 miles to the dam at the UNH water treatment plant in Durham, the Oyster River is partially free-flowing. Below this point, the river is free-flowing for 1.5 miles to the dam at the Durham Mill Pond located immediately west of Route 108. The elevation change from the headwaters to the mouth of the river is approximately 380 feet. Major tributaries of the Oyster River include Cadwell Brook, Wheelwright Pond, Dube Brook, Chesley Brook, College Brook, Pettee Brook, Beard's Creek, Hamel Brook, Gerrish Brook-Johnson Creek, and Horeshide Brook.

From the headwaters to the Route 4 crossing in Barrington, the river alternates between shallow, fast-flowing water with rock or gravel streambeds and deeper, slow-moving water in large, beaver-impounded swamps and marshes. The river meanders slowly over muck and sand bottoms through scrub-shrub palustrine wetlands and red maple swamps for 1.3 miles until it re-crosses Route 4 east of the Lee traffic circle. North of Route 4, the river is bordered by undeveloped forestland and some farmland and exhibits the classic pool and riffle structure that characterizes free-flowing second and third order streams. The river is either rock or sand with frequent marine sediment (silt and clay) streambanks. Below the gaging station and upstream of the dam at the UNH water treatment facility, the river bottom is dominated by soft-sediments and sand and meanders through streambanks characterized by outwash, till, or marine sediment. This stretch of the river has both fast and slow flowing sections of varying depths and widths. Below the gaging station and dam the river is occupied by the still waters of the Oyster River Reservoir. Below the dam at UNH, the river flows freely, exhibiting pool and riffle structure with a primarily rocky or sandy bottom for one mile until it enters the still waters of the Mill Pond impoundment. The river is ponded by the Mill Pond dam for 0.5 miles. At the dam, the river drops 18 feet to join the saline waters of the Oyster River estuary.

Refer to Chapter IV: Resource Assessment for discharge data.

[19] "Water Quality of the Oyster River, New Hampshire, 2001-2011," Oyster River Water Testing Committee. 2014.
[20] Oyster River Water Testing Committee . *Water Quality of the Oyster River, New Hampshire, 2001-2011*. 2014.
[21] Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.

Open Space

The Oyster River corridor is predominantly undeveloped. Forested land accounts for 59% of the land use within the corridor.

From its headwaters in Barrington to Old Mill Road in Lee, land use within the Oyster River corridor consists of forested and open wetlands with areas of residential development near Meadowbrook Drive in Barrington. This segment is classified as rural-community and includes a large portion of the Samuel A. Tamposi Water Supply Reserve, Rivers Edge Easement, and the Shultz-Friedlander parcel (the only one protected under the NHDES Water Supply Land Grant Program).[22]

From Old Mill Road northeast through Lee to Route 155, there is limited residential or commercial development and major land use types within the corridor are forested, open wetlands, and small areas of agriculture. This segment of the river is classified as rural. Tuckaway and Sheltering Rock Farms, which are protected under the NHDES Water Supply Land Grant Program, are within this segment. In addition to land, certain historical resources (buildings) are protected at Sheltering Rock Farms.

From Route 155, the river flows south along the Lee and Durham town border before heading east into Durham. This segment is classified as rural community. The primary land uses in this segment are forested and agriculture, including a nearly 100-acre parcel of agricultural land near Mast Road. From Mast road to Durham, there is no residential development. The river continues through UNH-College Woods, a 240-acre State protected easement, to the Oyster River Dam in Durham.

The river continues east from the dam through the urbanized town center of Durham to Mill Pond Dam. This segment of the river is classified as community. Residential, commercial, and institution (UNH) land dominate this segment of the river corridor. Small sections of forested land are present within this segment. The largest tract of forested land is the UNH-MacDonald Lot, a 36-acre State protected easement located behind Mill Pond Road.

Nearly one-third of land (1,287.4 acres) within the river corridor and one-third of land (6,377.4 acres) within the watershed is protected through a combination of federal, state, municipal and private owned properties with some easements held by non-profit organizations.[23]

Managed Resources

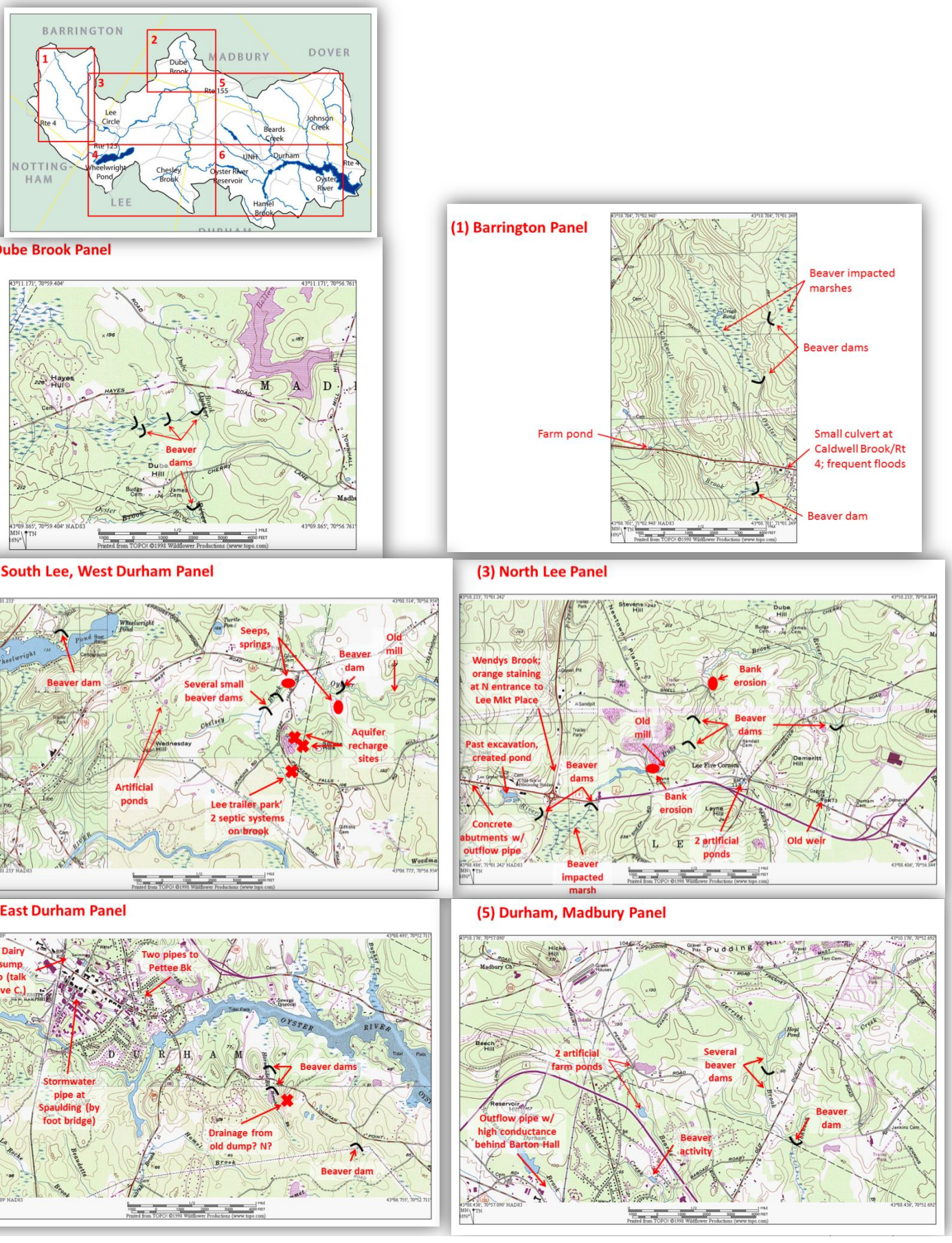
Impoundments

There are five impoundments on the Oyster River. The Oyster River Reservoir Dam in Durham is owned by UNH and is water supply source for the University and town. This impoundment has dam height of 21 feel and drainage area of 16.58 acres. The Mill Pond Dam, located in and owned by the Town of Durham, is an active dam that supports recreation. This impoundment has a 10 foot dam and 20 acre drainage area. The status of the remaining three dams is 'ruins'. The Oyster River I Dam and Oyster River II Dam, privately owned and located in Lee, are both recreational dams that are in ruins with drainage areas of 11.28 acres and 8.14 acres, respectively. The Oyster River Double Wall Dam in Durham supports recreation, is eight feet tall, and drains an area of 16.5 acres. This dam is also privately owned.[24]

There are several beaver dams located along the Oyster River and its tributaries. The maps in Figure 11 display the location of beaver dams present in 2013.

[22] Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.
[23] Ibid.
[24] NH Dam Listing Provided By NHDES, 2007. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)

Figure 11. Location of impoundments within the Oyster River watershed.



[Source: Weyrick, Dick, et al. Oyster River, Notes on beaver impact, bank erosion, and other characteristics. June 2013.]

Riparian Interests and Flowage Rights

Flowage rights are as follows:

> *The Towns of Durham, Epping, Lee, Newmarket, and Raymond shall have the use of the waters of the Lamprey River and its tributaries within said towns for the purpose of public water supplies to the exclusion of all other municipalities. Durham shall have the right to acquire by purchase or by eminent domain in accordance with the procedures of RSA 38:13 and 14 (1) the right to divert waters from the Lamprey River by means of any dam that it may build or acquire at or near: the location of the dam at Wiswall Falls and (b) flowage rights in the Town of Lee to the extent necessary to maintain a dam at the Falls at or near the location of the dam owned by Carl. F. Spang. The Town of Durham shall have the right and authority to protect the purity of the water from the Lamprey River as granted under RSA 38:21 provided that there shall be no curtailment of present or future recreational uses, namely, swimming, boating and fishing.*
>
> *Any person who shall willfully and maliciously corrupts the waters of any of the sources of supply or reservoirs of the Durham Water Works Company, or shall willfully injure any dam, reservoir, conduit, pipe, hydrant, or other property held, owned, or used by said company, for the purposes of this act, shall, on conviction of either of said acts, be punished by fine not exceeding five hundred dollars, or be imprisoned not exceeding one year. There are no known significant flowage rights on the Oyster River* (Durham-UNH Water Works. 1965 C. 332-1; 1998 UNH Doc.).

Hydroelectric Resources

There are no existing hydroelectric power production facilities on the Oyster River. A potential hydroelectric power site has been identified on the river at Mill Pond Dam.

Cultural and Historical Resources

Historical or Archaeological Resources

The Piscataqua region's abundant plants, mammals, and fish sustained Native Americans some 11,000 years ago. The large tidal area of the Oyster River below the Mill Pond Dam was originally used by the Native Americans as a seasonal camping ground and for harvesting shellfish.[25]

The first clusters of European settlements occurred at the mouths of the region's rivers in the early 1600s. The Great Bay and its tributaries – which were rich in natural resources, enabled easy transportation of goods, and provided power for machinery -- were of great important to the European settlement period of the New Hampshire seacoast. The Oyster River was called the Shankhassick by Native Americans and was renamed by Europeans for its shellfish beds when its banks were settled in the 1630s. By 1639 the beginnings of a scattered English Village, the "Oyster River Plantation," was discernible along the lower banks. The banks of the Oyster River yielded good quality blue clay and supported dozens of brick yards. There were also at least two locations for shipbuilding at the mouth of the river and just below Mill Pond, where schooners, privateers and many gundalows were constructed.[26]

Shipbuilding in Durham

[Image: John Hatch, UNH Library]

[25] Bolster, Jeffery W. & Randall, Peter E. *Cross-Grained and Wily Water: A Guide to the Piscataqua maritime Region,* 2002. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)
[26] Stackpole, Everett S. & Thompson, Lucien. *History of the town of Durham, New Hampshire.* Published in 1913 by vote of the Town. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)

There are a number of historical sites and quality natural areas along the river and the river continues to be of significant value to the region. At the headwaters of the river, which is formed by small streams feeding the wetland at Creek Pong, the river runs through the 1,400-acre Samuel A. Tamposi Water Supply Reserve, which was protected in 2001 for its valuable water resource by the town of Barrington and the Society for the Protection of New Hampshire Forests with the cooperation of five other towns and the University of New Hampshire.[27]

Remnant stone work of the New Town mill, which was built prior to 1712 and later referred to as Layne's mill, can be seen just downstream of Mill Road in Lee. This mill was first a sawmill and later may have been a gristmill. The Town of Lee and the USDA Natural Resource Conservation Service are restoring wetlands and constructing an Atlantic white cedar swamp on land abutting this mill site, where sand and gravel extraction has occurred. Approximately three quarters of a mile downstream toward Madbury, there are remains of a small sawmill in the vicinity of the Snell Road crossing.[28]

Downstream of the point where the Oyster River is joined by Dube Brook in Madbury, the river sustained a sawmill known as Emerson's mill, and later called the Demerrit dishwater mill, at certain times of the year when the flow was great enough. This mill was remodeled in 1801 and removed in 1910 to provide material to build a barn.[29]

Further downstream, a USGS gauging station located at State Route 155A where the river crosses from Lee into Durham has collected flow data for the river since 1934.[30] The first railroad bridge was built across the river in 1841 downstream of the reservoir. The current and third railroad bridge was built in 1911 at which time the course of the river was changed to accommodate the need for a solid foundation for the bridge footings.[31]

Remnants of a dam for the Chesley's mill, laid out in 1703, are visible downstream of the railroad bridge just west of Mill Road in Durham. This mill was first a sawmill and later converted to a grist mill. Additionally, there was also a fulling mill at this site for cleansing wool.[32]

The mill at Mill Pond road, also called Durham Falls was the last mill before the tidal portion of the river and likely the major milling operation on the Oyster. This mill was privileged in 1649 and used for a saw mill, grist mill, cider mill, and a machine shop over the almost 300 year existence of the Mill Pond dam. The dam is New Hampshire's earliest known example of an Ambursen dam, a type of dam that relies on a series of evenly space concrete buttresses anchored in the bed of the river. Today Mill Pond and the dam are a scenic focal point of the community.[33]

Within or in close proximity to the Oyster River corridor there are three nationally recognized historic resources (Table 20).

[27] Wiggin, Morton H. *A History of Barrington, NH.* © Joan Wiggin, 1966. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)
[28] Personal communication with Dick Wellington of Lee. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)
[29] Thompson, Mary P. *Landmarks in Ancient Dover, New Hampshire.* Durham Historical Association. 1892, re-published 1965. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)
[30] Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.
[31] Personal communication with Janet Mackie, Vice President Durham Historical Association. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)
[32] Thompson, Mary P. *Landmarks in Ancient Dover, New Hampshire.* Durham Historical Association. 1892, re-published 1965. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)
[33] Town of Durham. *History of the Oyster River Dam.* Presentation. Town of Durham website. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)

Table 20: Historical and Archaeological Resources

Historical/Archaeological Resource	Listing/Eligibility	Location	Community
John Sullivan House	NHL	23 Newmarket Road	Durham
Durham Historic District	HD	Main St. & Newmarket Rd.	Durham
Thompson Hall*	NRHP	Main St. & Newmarket Rd	Durham

*Thompson Hall is not within the river corridor but is located in close proximity
[Source: National Register of Historic Places, National Historic Landmarks Survey]

Community Resources

The Oyster River is a significant resource to the community. The importance of the Oyster River as a community resource is reflected in the local planning and protection efforts of the four communities along the River. See Chapter V: Land Use Assessment for information about land use protection within the watershed and surrounding communities.

The Oyster River, Lee Well and Spruce Hill aquifer, and water withdrawn and transferred from the Lamprey River to the Oyster River comprise the drinking water sources for UNH and the Town of Durham. UNH's Arthur Rollins Water Treatment Plant is located off Waterworks Road within College Woods in Durham. The UNH/Durham Water System serves a population of approximately 16,000 and has a capacity of 1.5 million gallons per day (mgd). The Oyster River reservoir has an estimated storage volume ranging from 9 to 14.7 million gallons.[34]

The Durham wastewater treatment facility (WWTF) is also located on the Oyster River, downstream of the Mill Pond dam in the tidal section of the river. The WWTF serves Durham and UNH and has an average flow of 1.1 mgd when UNH is in session and 0.6 mgd when UNH is on break. Wastewater from the WWTF undergoes primary and secondary treatment, nutrient removal through activated sludge with an anoxic zone, disinfection with chlorine, and chemical addition for pH adjustment prior to being discharged into the Oyster River.[35]

The Oyster River is an excellent outdoor classroom for hands on learning about aquatic biota, water chemistry, pollution, and river flow, as well as for developing skills in conducting scientific research and collecting field data. Students and faculty also use the river as a research site.

Recreational opportunities provided by the Oyster River are described in the following section.

Recreational Resources

Fishery

There are three well-known and well-utilized fishing locations on the Oyster River. The upper part of the river, upstream of the Route 155A crossing in Durham, is fished for wild and stocked brook trout. In May of 2014, the Oyster River was stocked with 620 brook trout Durham (480) and Lee (140).[36] Wheelwright Pond, located within the river corridor, contains and excellent warm water fishery for largemouth bass, yellow perch, and sunfish (including black crappie). The tidal portion of the Oyster River is a well-known winter smelt fishery. With adequate river herring runs, this part of the river also has the potential to be a striped bass fishery.[37]

[34] *Water Use Plan,* University of New Hampshire/Durham Water System (#20066).
[35] Ibid.
[36] New Hampshire Fish and Game. *NH Fish Stocking Summary.* May 2014.
[37] Matt Carpenter, New Hampshire Fish and Game Department. (From Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.)

Boating

Boaters can access the Oyster River downstream of the Mill Pond Dam from the Oyster River Landing or Jackson's Landing. There is no ramp at Old Town Landing and boat launching is limited to canoes, kayaks, and rowboats. The dock at Old Town Landing provides access to boats that are moored in the Oyster River. Depending on the tide, Jackson's Landing is accessible for all boats, including motorized boats. The boat shed and dock are shared by the Town of Durham and UNH. Boating at Mill Pond is limited to canoes, kayaks, and rowboats.[38]

Other Recreational Opportunities

In addition to fishing and boating, the Oyster River provides a range of recreational opportunities for birding, hiking, swimming, and ice skating. Notable recreational resources in the river corridor and watershed are described in the tables below.

Table 21: Recreational resources in the Oyster River Corridor and Watershed

Recreational Area	Location	Acres	Ownership	Description and Amenities	Drainage
DeMerrit Memorial Park	155 and Town Hall Road, Madbury	12	Town of Madbury	• 2 baseball fields, soccer field • 4 acres of wooded area with trails • Picnic area • Historical marker	Drains to Beards Creek and then to the tidal portion of the Oyster River
Tibbets Property	Town Hall Road, Madbury	49.18	Town of Madbury	• 2 large open fields • White pine and mixed hardwood woodlands used for hiking, biking, and horseback riding • Soccer field • Natural areas with wildlife habitat and opportunities for forest management	Wetlands flow into Beards Creek and then to the tidal portion of the Oyster River
Gerrish Brook Natural Area	Garrison Lane, Madbury	6.74	Town of Madbury	• Hiking trails • Wildlife habitat • Red-finned pickerel, a species of interest in the region • Abuts Hoyt Pond Conservation and Recreation Area, which has a one acre fly fishing pond and beaver dams	Drains to Gerrish Brook, which joins Johnson Creek and drains into the tidal portion of the Oyster River
Jackson's Landing	Old Piscataqua Road, Durham	~ 1.5 acres,	Town of Durham	• Dock provides access for all boats, depending on the tide • Boat shed and dock shared by Durham and UNH • Picnic tables and benches • Playground • UNH boat house • Public crew space	Located on the tidal portion of the Oyster River and marsh
Oyster River Landing	Old Landing, Road, Durham	3	Town of Durham	• Non-motorized boat access • Dock provides access to boats moored in the Oyster River • Picnic tables and benches • Historical information	Located on the tidal portion of the Oyster River and marsh

[38] Outdoor Recreation Sites. Parks & Recreation, Durham, NH.

Oyster River Park	Mill Road, Durham	4.5	Town of Durham	• Mowed fields, woodlands • 0.4 miles trails • Benches	Drains to Oyster River
Hoyt Pond Conservation and Recreation Area	Route 108, Madbury	37	Town of Madbury	• Fly-flying impoundment managed by NH Fish and Game • Woodlands • Undeveloped trail used for hiking, snowshoeing, and cross-country skiing • Red-finned pickerel habitat in Gerrish Brook	Drains into Gerrish Brook, which joins Johnson Creek and flows into the tidal portion of the Oyster River
College Woods	Entrances near Mast Road south of Main st. and behind the UNH Field House from Service Road	250	UNH	• 1 mile of river stretch • Reservoir • Woodlands • Natural area • 3-4 miles of well-maintained trails, plus intermittent trails	Drains into Oyster River
Bolstridge Forest	Hayes, Town Hall, and Cherry Lane, Madbury	90	Town of Madbury	• Mixed terrain including woods, fields, and wetlands • Undeveloped trails • Popular hunting ground	Wetlands drain to Dube Brook, which flows into the Oyster River making it a 4th order stream
Samuel A. Tamposi Water Supply Reserve	Tibbetts Road, Barrington	1,377	Town of Barrington	• Headwaters of the Oyster and Bellamy Rivers, which are significant water supplies for the coastal communities • Variety of habitats • Populations of moose, bear, fox, and fisher • Globally rare Atlantic white cedar swamp • Protected by an easement held by the Society for the Protection of NH Forests	Headwaters of the Oyster and Bellamy Rivers
Town Forest Complex	Clement Way, 155/Mast Road, George Bennett Road	196	Town of Lee	• 850 feet of shoreline on Wheelwright Pond (100 acres) • Most of land protected by a conservation easement • Walking trails	Flows into the Oyster River near the Lee traffic circle
Old Mill Reserve	Old Mill Road, Lee	90	Town of Lee	• 2,300 feet of Oyster River shoreline • NRCS Wetland Restoration Project completed in 2010 • Part of a larger, town-and privately-owned area protected under conservation easements	Drains into the Oyster River

[Source: Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.]

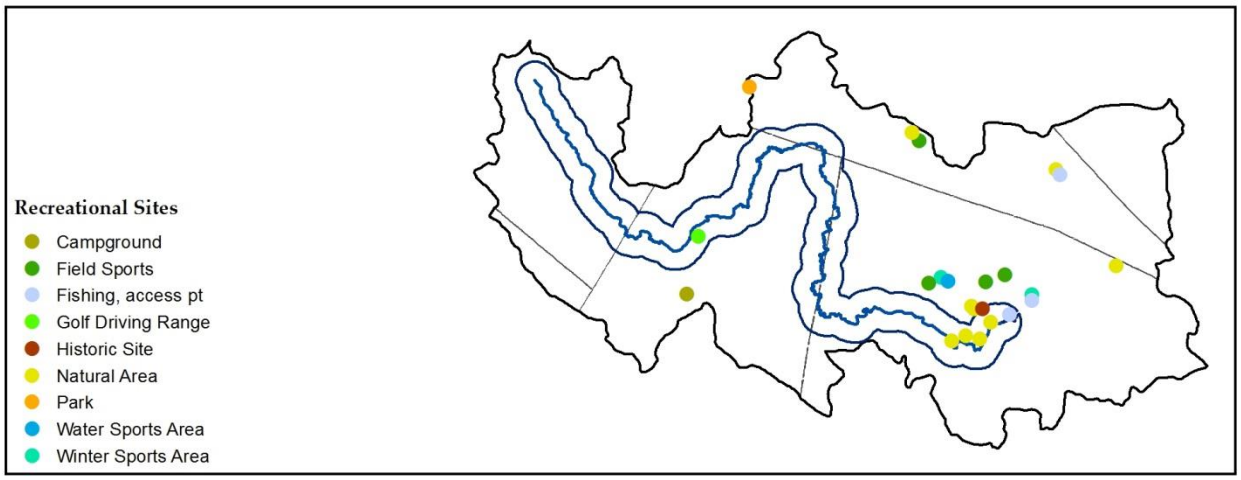
Table 22: Recreational Sites in the Watershed

Recreation Area	Community	Primary Use	Acres
Hayes Hill	Madbury	Park	2.35
Madbury Town Park	Madbury	Field Sports	15
Tibbetts Property	Madbury	Natural Area	49.2
Gerrish Brook Area	Madbury	Natural Area	6.7
Hoyt Pond	Madbury	Fishing Access Point	1
Bunker Creek	Durham	Natural Area	1
Oyster River High	Durham	Field Sports	5
Whittemore Center	Durham	Winter Sports Area	3
Oyster River Middle	Durham	Field Sports	4
UNH Outdoor Pool	Durham	Water Sports Area	2
UNH Field House	Durham	Field Sports	19
Forest Glen	Lee	Campground	50
Durham Skating Rink	Durham	Winter Sports Area	5
Jacksons Landing	Durham	Fishing Access Point	2
Memorial Park	Durham	Natural Area	0.1
Centennial Park	Durham	Natural Area	0.5
Durham Historic	Durham	Historic Site	80
Old Town Landing	Durham	Fishing Access Point	3
Mill Pond and Oyster	Durham	Natural Area	1
Thompson Tot Lot	Durham	Natural Area	0.5
Smith Chapel	Durham	Natural Area	2
Oyster River Park	Durham	Natural Area	4.5
Fore on 4	Lee	Golf Driving Range	8

Note: Figure 9 displays the location of these sites.

[Source: NH GRANIT]

Figure 12. Recreational sites in the watershed



[Source: NH GRANIT]

Public Access

Ten access points to the Oyster River are described in the table below.

Table 23: Public access to the Oyster River

Community	Location	Ownership	Description
Barrington	Samuel A. Tamposi Property	Barrington	Headwaters of the Oyster River and a Society for the Protection of New Hampshire Forests easement. Residents interested in using the trail system or pond for non-motorized recreation can park in a pullout space next to Province Road across from the Pond View retirement Home on Route 9.
Lee	Old Mill Road	Lee	Kelley and Cheney gravel pits being restored to wetlands. Access to river.
	Route 155 at bridge and power line crossing	NHDOT	Wide-turnoff. Could handle several cars on both sides. Has hunter access.
	Route 155A crossing at USGS gauging station	Lee	Turnoff on Mast Road next to the Swaan Drive Open Space conservation easement. Access to the river.
Durham	College Woods	UNH	College Woods main trails on Colovos Road, behind the UNH Field House. Parking is available at the trailhead. Access for walking, running, and general natural relaxation.
	College Woods	UNH	Kiosk behind the UNH water treatment plant. Leads down to the river. Limited parking. Access to hiking, walking, skiing, jogging, bird watching, and general relaxation. Other activities occurring in areas outside the Natural Area are horseback riding, biking, and hunting (except North of the Oyster River).
	Oyster River Park	Durham	Small neighborhood park with mowed fields and woodlands along the river that has access for walkers and benches for picnicking.
	Public Park	Durham	Public access area at Mill Pond. Access for canoes, kayaks, and rowboats.
	*Jackson's Landing	Durham	Public park and ramp access for all boats. Tide dependent for motorized boats. Boat shed and dock shared by the Town and UNH. There are tables and benches at the playground for small children and a covered ice-skating rink.
	*Wagon Hill	Durham	Public land with access to woodlands, fields, tidal marsh and bay. Trails run through northern part of the Farm connects with Route 108 at the Evangelical Church. Carry-on launching access 0.5 miles from parking lot. There are picnic tables for visitors. Wagon Hill is also a popular sledding location for local residents in the winter. Site of Durham Community Gardens.

[Source: Oyster River Watershed Association]

Scenery

An extensive portion of the Oyster River corridor passes through farmland and forests removed from public access and viewing. There are, however, many scenic views of the river and riparian features from public road crossings, access points, and College Woods. These scenic views are described in Table 24.

Footbridge in College Woods

[Image Credit: Ben Kimball]

View of the Oyster River near Mill Pond Dam

[Image Credit: MinerDescent.com]

Table 24: Locations to view the Oyster River.

Community	View site	Description
Barrington	Road crossing	View of river as it flows from the Samuel A. Tamposi Water Reserve at the bridge of the entrance road toe Emerald Acres mobile home community a few hundred feet below where the river is joined by a major tributary, Caldwell Brook. The stream flows freely, and the water is clear through colored due to its organic bog origins in Atlantic white-cedar and peat moss swamps
	Road crossing	Limited views of the very slow-flowing, braided stream to the south of Route 4 west of Lee traffic circle.
	Paths and trails	Views of pristine sections of the river from several old Town roads with walking access that crosses various portions of headwater streams in the Tamposi Reserve. Stone walls and building foundations located along these road date to the time when this was a farm community. The most common access point to the reserve is at the end of Tibbetts Road off Hall Road.
Lee	Road crossing	View of the brushy, wooded wetland area at the 125 crossing south of the Sunoco station.
	Road crossing	Upstream and downstream view of the river at the Route 4 crossing. Upstream, the brushy wetland is hundreds of acres and serves as an important flood plain. Downstream, the river becomes more free-flowing, passing over an old beaver impoundment into a well-defined channel. Vehicles can stop along the highway at the gas station and at the driving range on either side of the river.
	Road crossing	View of free-flowing section of the river from Old Mill Road. Downstream view is a falls at the site of the old mill for which the road is names.
	Road crossing	View of free-flowing section of the river at Snell Road.
	Road crossing	View of free-flowing section of the river at rural highway crossing at Route 155 north of Lee Five Corners. Parking area nearby.
	Road crossing	View of free-flowing section of the river at rural highway crossing at Route 155A (Old Concord Turnpike) east of Lee Five Corners near Durham. Parking area nearby. This location is frequently stocked with trout. Site of a USGS gauging station where flow measurements have been taken continuously for 75 years.
	Road crossing	View of free-flowing section of the river at rural highway crossing at U.S. Route 4 near Durham.
	Road crossing	View of free-flowing section of the river at rural highway crossing at Route 155A (Mast Road) near Durham.
	Paths and trails	Several views of the river from the Oyster River Reserve located opposite the USGS gauging station along Old Concord Turnpike. The east shore of the river is forested flood plain with easy access to the river in several places. This area is often covered with 1-3 feet of water during and following sever storm events. The west side of the river is accessible via a Boy Scout-constructed walking train that comes to the river banks in several places.
Durham	Road crossing	View of free-flowing section of the river at the Mill Road crossing downstream from the UNH-Durham water supply reservoir.
	Road crossing	View of free-flowing section of the river at Route 108 (Newmarket Road) just downstream from the Mill Pond Dam in Durham. The river is tidewater from that point downstream. Mill Pond is a very scenic area with easy driving and parking access along Mill Pond Road. Downstream from the dam, the Durham Landin Park is accessible via Old Landing Road, with parking, landscaped open area, picnic sites and a footbridge across the river.
	Paths and trails	Several viewing locations within UNH College Woods, which extends over 200 acres on either side of the river and the water supply reservoir. There is an extensive network of trails throughout the property and many trails run adjacent and cross to the shores of the stream with foot bridges. Over 60 acres of the land is designated a Natural Area. Some trails are designed to be handicap accessible.

[Source: Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.]

Chapter IV: Resource Assessment

Water Quality Monitoring

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine where improvements, restoration or preservation may benefit the river and the communities it supports. Water quality results are also used to determine if a river is meeting surface water quality standards.

Volunteer monitoring results that meet DES Quality Assurance and Quality Control (QA/QC) requirements supplement efforts to assess the condition of New Hampshire surface water. Volunteer data are used in conjunction with data collected from water quality programs including the State Ambient River Monitoring Program to support periodic DES surface water quality assessments. As required by the federal Clean Water Act, DES publishes the assessment results and the methodology (Section 305 (b) Water Quality Reports) used to assess surface waters every two years.[39]

The Water Quality Testing Committee of the Oyster River Watershed Association is the primary volunteer group that collects water quality data on the Oyster River and its tributaries. Additional groups that have collected water quality data include the UNH Water Systems Analysis Group, UNH Water Resource Research Center, and Piscataqua Region Esuraries Partnership.

USGS Gage Station

There is one USGS Gage Station located on the Oyster River near Durham. Data has been collected at this station from 1934 to the present. This data is available at the USGS National Water Information System Web Interface (http://waterdata.usgs.gov/nwis). The station is managed by the Pembroke, NH Field Office.

USGS Gage Station #01073000
Latitude: 43°08'55",
Longitude: 70°57'56" NAD27
Gage Datum: 65.29 feet above sea level NGVD29
Hydrologic Unit 0106003
Drainage area: 21.1 square miles

Volunteer River Assessment Program (VRAP)

The New Hampshire Volunteer River Assessment Program (VRAP) was established to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology and to improve water quality monitoring coverage for the protection of water resources. VRAP is a cooperative program between DES, river groups, local advisory committees, watershed associations, and individuals working to protect New Hampshire's river and streams.

The Oyster River water monitoring project was established in 2001 with the primary objective of describing the quality of water in the Oyster River and its tributaries at many sites throughout the watershed, during different times of the year, and over many years. A secondary goal of the monitoring project was to detect decline in water quality and take action to ameliorate the decline attributable to human activity.

A summary of data collected from 2001-2011 as well as the most current data available from 2013 follows. Current and historical water quality data is available on the DES website at http://des.nh.gov/organization/divisions/water/wmb/vrap/oyster/index.htm.

[39] Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.

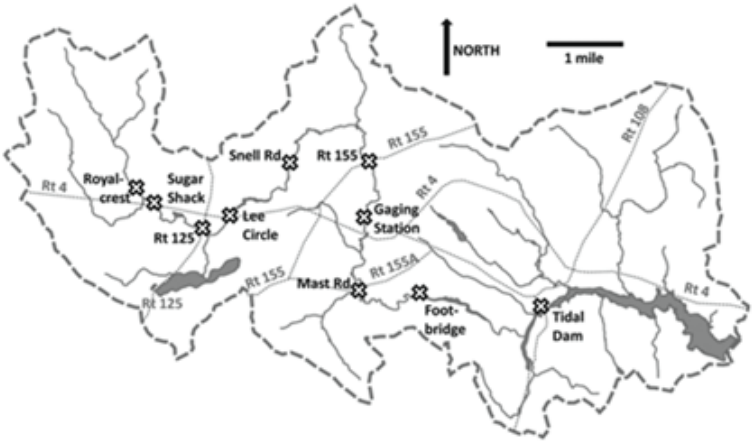
2001-2011 Sampling Data Summary

In February 2014, the Oyster River Water Testing Committee prepared the Water Quality of The Oyster River, New Hampshire, 2001-2011 report that summarizes data taken from 21 sites in the Oyster River watershed and collected over the 11 year period. See the water quality report for more information. Data collected include:

1) **Specific conductance:** a measure of the abundance of dissolved, ionic substances
2) **Individual ions:** chloride, sodium, phosphate, and various forms of nitrogen
3) **Dissolved oxygen**
4) **Turbidity:** a measure the amount of particulates suspended in the water column
5) **pH:** a measure of acidity (H+ concentration)
6) **Water temperature**
7) **Bacteria** (counts of *Escherichia coli*): indicate possible presence of pathogenic bacteria

From 2001 through 2011, water quality was measured at over 25 different sites in the Oyster River watershed. Sites were limited to the freshwater portion of the main stem and its tributaries, although some of the sites were located on tributaries that directly feed the estuarine portion of the river. Data from 10 sites located on the Oyster River main stem and 11 sites located on tributaries were analyzed (see Figure 13). Sites that were sampled in only one year are not included. Physical variables including specific conductance, dissolved oxygen, turbidity, pH, and water temperature were measured in every year. Ions were only measured in 2001, 2002, and 2005-2010. Not all sites were sampled every year. Counts of Escherichia coli, a coliform bacteria that indicated decal contamination, were made at most of the sites and years at which physical variables were sampled.

Figure 13: Location of sampling sites on the Oyster River (above) and tributaries (below.)



Site Name	Site
Main Stem	
Royalcrest	15C-OYS
Sugar Shack	15-OYS
Route 125	13A-OYS
Lee Circle	13-OYS
Snell Road	11-OYS
Route 155	10-OYS
Gaging Station	9-OYS
Mast Road	8-OYS
Footbridge	7-OYS
Tidal Dam	5-OYS

Tributaries	
Caldwell Brook	01-CWL
Wheelright	01-XBB
Wendys Brook	01-WDY
Dube Brook	01-DBE
Chesley Brook	01-CSB
College Brook	00E-CGB
Hamel Brook	01-HML
Pettee Brook	01-RSV
Beards Creek	02-BRD
Stolworthy	02G-BRD
Johnson Creek	03-JNC

[Source: Oyster River Water Testing Committee. *Water Quality of the Oyster River, New Hampshire, 2001-2011.*]

Specific conductance

Conductance at main stem sites generally increased from upstream to downstream, ranging from an adjusted mean of only 57 μs/cm to 183 μs/cm. Individual observations of conductance on specific dates were sometimes above 200 μs/cm, but none of the site means exceeded this value. Conductance varied greatly among tributary sites. Seven of the 11 tributary sites had adjusted mean values above 200 μs/cm. With the exception of Wendys Brook (01-WDY), sites with values > 200 μs/cm were downstream of the Durham Reservoir. Three sites in urban settings (Wendys Brook, Pettee Brook, and College Brook) had high mean values (>400 μs/cm). Four upstream tributary sites (Caldwell, Wheelright, Dube, and Chesley) had low mean conductance (<200 μs/cm).

Over the 11-year sampling period of 602 individual observations at main stream sites, conductance values never exceeded 835 μs/cm, which is the value associated with chloride levels (230 mg Cl/L) that negatively impact aquatic life when continuously applied. At 52 of the 676 individual observations at tributary sites conductance was ≥ 835 μs/cm.

The adjusted mean specific conductance was highest in 2001, 2002, and 2003 than other years, likely due to low discharge (water flow) in these years. Specific conductance was greater in July, August, and September and lowest in November, also likely related to discharge.

Discharge

One, two, and three day discharge data from the USGS gaging station (site 09-OYS) shows that mean monthly discharge for sampling months (April-November) was lowest in 2001, 2002, 2003, and 2010, and lowest in the months of July, August, and September.

Individual Ions

The source of most of the sodium and chloride in New Hampshire streams is road salt. Sodium and chloride were generally highest in the downstream areas of the watershed where there are higher levels of impervious surface and high road density.

a) Chloride

Adjusted means of chloride (Cl^-) concentration varied significantly among main stem sites over the 2001-2011 sampling period. On the main stem sites, mean chloride levels never exceeded 40 mg Cl/L, although some individual values were higher. Individual values never exceeded 100 mg Cl/L at any site and therefore were below the state "chronic" standard of 230 mg Cl/L. At tributary sites, chloride concentrations also varied significantly. Three tributaries (College Brook, Pette Brook, and Wendys Brook) had mean chloride concentrations > 70 mg CL/L, and College Brook had the highest concentration at 141 mg Cl/L.

b) Sodium

Sodium (Na+) levels carried among main stem sites and tributary sites. Patterns across sites were almost identical to those of chloride for both the main stem and tributaries

c) Phosphate

High levels of phosphorus results in algal blooms and eutrophication. Mean phosphorus levels at all Oyster River sites were low (<10 μs/L). Phosphorous concentrations at main stem sites increased slightly but significantly from upstream to downstream and declined downstream of the footbridge site in College Woods. Phosphorus concentrations did not vary significantly among tributary sites.

d) Nitrate

Nitrate enters streams naturally from rainwater and leaching from soils. Septic systems are also a source. Adjusted mean nitrogen levels in nitrate (NO_3^-) varied significantly by site but were very low (<0.1 mg N/L) at most main stem sites. Nitrate-N levels were generally higher at tributary sites than main stem sites. \

e) Ammonium

Nitrogen in ammonium (NH_4+) is typically present at much lower concentrations than nitrogen in organic compounds. Ammonium-N was present at very low concentrations at main stem sites and did not vary significantly among them. Concentrations of Ammonium-N were also low at most tributary sites with significant variation among sites. There were high levels of ammonium at Wendys Brook relative to the other Oyster River

sites as well as to nitrate and dissolved organic N at the Wendys Brook site. High levels of bacteria were also observed at this site, indicating that there may be a faulty septic unit upstream from the sampling site.

f) Dissolved Organic Nitrogen (DON)

Mead dissolved organic nitrogen was always <0.4 mg N/L, although there was significant variation from site to site along the main stem and among tributary sites. On the main stem, DON declined from >0.3 mg N/L in the four upstream sites to <0.3 mg N/L in the five downstream sites. Among the tributary sites, three sites (Wendys, Chesley, and College Brooks) had the lowest DON concentrations.

g) Total Dissolved Nitrogen (TDN)

Total dissolved nitrogen reflected the individual patterns of the various forms of dissolved nitrogen, especially nitrate. The highest values at Mast Road and Footbridge coincided with high nitrate-N levels. The highest TDN values among tributary sites were associated with Wendys Chesley, and College Brooks and also coincided with patterns of nitrate-N.

h) Nitrogen by Form

Main stem sites were consistently dominated by DON, but variation among sites in TDN were influenced by the greater variance in nitrate. In contrast, tributary sites varied greatly not only in TDN but in the contributions of the different forms of N.

Dissolved Oxygen

Dissolved oxygen (mg O/L) and % saturation are affected by discharge. Data from the USFS gaging station at Sherburne Road in Lee (09-OYS) shows that as the amount of discharge increases, dissolved oxygen concentrations expressed in mg/L increase. Among the 10 main stem sites, mean dissolved oxygen varied significantly. Dissolved oxygen was high (>9 mg/L and >80% of saturation) at eight sites but were low at the Route 125 and Lee Circle sites. At these sites, the low mean values exceeded the state standard for mg O/L (6 mg O/L0 but were below the state standard for % saturation (75%). Low dissolved oxygen at these sites is likely caused by natural processes. Mean dissolved oxygen also varied significantly among tributary sites but was generally high. Three of the 10 sites fell below the state standard of 75% saturation. Dissolved oxygen at main stem and tributary sites was generally lower in years of low flow and varied significantly across the months of the year.

Turbidity

Mean turbidity at main stem sites (measured in nephalometric turbidity units (NTU)) was generally low (<7 NTU) at the main stem sites, but varied significantly among them. Turbidity was lowest (<1 NTU) at the upstream sites and increased progressively downstream. Mean turbidity also varied significantly among tributary sites and high turbidity values do not appear to be due to human impact. Average turbidity varied significantly by year and by month in both the main stem and the tributaries. On the main stem, turbidity was greater in the first five years of the study and about 20% lower in the last six years. Turbidity was not associated with annual discharge at the gaging station. Mean turbidity was low in spring and fall and high from June through September.

pH

Mean pH varied significantly among the main stem sites and was highest (>6.3) at the six sites downstream of Lee Circle. Mean pH also varied significantly among tributary sites, with the highest pH values found in College and Pettee Brooks which are both highly urbanized and impacted streams. Mean pH varied significantly among the years and across months within the sampling years and varied slightly and erratically over the 11 years of the study.

Water Temperature

Mean water temperature varied significantly across the main stem sites and were greatest at Royalcrest and lowest at the Tidal Dam, with little variation in between. Mean temperatures also varied significantly across tributary sites. Across the 11 years of the study, mean water temperature varied significantly.

Bacteria

For nine sampling sites (excluding Snell Road site 11-OYS), more than half of the observed E. coli counts were in the NH class A category (≤ 153 counts/100 ml). Between 8 and 30% of observations at each site were in class B. All sites had at least 6% of observations below grade B standards (>406 cts/100 ml), and seven of the sites reported at least one value > 1,000 cts/100 ml) (see Table 24). There was much more variation in E. coli counts among tributary sites (Table 25).

Table 25: Percent of Oyster River bacteria (E. *coli*)

Main Stem Sites	% class A	% class B	% > 406	% > 1,000
Main Stem Sites (mean)	68	19	13	8
Tributary Sites (mean	41	22	37	20

Notes: observations (counts/100ml) taken from 2001-2011 meeting the New Hampshire state standard for class A water (≤153 cts/100ml), class B water (≤406 cts/ml), and neither class (>406 cts/100 ml), and percentage of observations with greater than 100 cts/100 ml.

[Source: Oyster River Water Testing Committee. *Water Quality of the Oyster River, New Hampshire, 2001-2011.*]

VRAP Water Quality Monitoring Conclusions and Recommendations

Long-term studies of water quality should allow detection of directional decline or improvement in water quality over time. Although the mean values of specific conductance, dissolved oxygen, turbidity, pH, temperature, and most ions varied significantly over the 11 years of the study, the only variable that showed directional change was turbidity. The trend toward lower turbidity over the duration of the study should, if anything, be viewed as a positive trend.

The water quality at most sites on the main stem of the Oyster River and on its tributaries appeared to be unimpaired or minimally impaired by human activity. However, three tributaries (College Brook, Pettee Brook, and Wendys Brook) have conductances and nutrient levels typical of streams impacted by urbanization. These tributaries should be monitored closely to document any further deterioration, and should be targeted for remediation or restoration. The unusually high bacteria counts and ammonia levels at Wendys Brook call for immediate response.

2013 Sampling Data Summary

Sampling data for the Oyster River from 2006 through 2013 is available on NH DES's VRAP website: http://des.nh.gov/organization/divisions/water/wmb/vrap/oyster/index.htm. The table below displays the sampling site locations for 2013. Table 26 summarizes the New Hampshire surface water quality standards in 2013.

Table 26: Sampling station for the Oyster River Watershed, NHDES VRAP, 2013

Station ID	Site Name	Waterbody	Location	Community	Class
01-CWL	Caldwell Brook	Caldwell Brook	Route 4	Barrington	A
15C-OYS	Royalcrest	Oyster River	Emerald Drive	Barrington	A
13A-OYS	Route 125	Oyster River	Route 125 Crossing South of Lee Traffic Circle	Lee	A
01-XBB	Wheelwright	Wheelright Pond Outlet	Stepping Stone Road Bridge	Lee	A
13-OYS	Lee Circle	Oyster River	Route 4 Bridge, East of Lee Traffic Circle	Lee	A
01-WDY	Wendys Brook	Wendys Brook	Footbridge 500' Upstream of Confluence with Oyster River	Lee	A
01-DBE	Dube Brook	Dube Brook	Cherry Lane Bridge	Madbury	A
10-OYS	Route 155	Oyster River	Route 155 Bridge	Lee	A
09-OYS	Gaging Station	Oyster River	Route 155A Bridge (USGS Gaging Station)	Lee	A
08-OYS	Mast Road	Oyster River	Mast Road Bridge	Durham	A
01-CSB	Chelsey Brook	Chelsey Brook	Packer's Falls Road Bridge	Lee	A
07-OYS	Footbridge	Oyster River	Footbridge, College Woods	Durham	A
01-HLM	Hamel Brook	Hamel Brook	Route 108 Bridge	Durham	B
0EE-CGB	College Brook	College Brook	Mill Pond Road Bridge	Durham	B
00J-PRB	Pettee Brook	Pettee Brook	Sauer Terrace	Durham	B
02G-BRD	Stolworthy	Beards Creek	Stolworthy Wildlife Sanctuary	Durham	B
02-BRD	Beards Creek	Beards Creek	Coe Drive	Durham	B
03-JNC	Johnson Creek	Johnson Creek	Freshet Road Bridge	Durham	B

Source: NH DES Water Division. 2013 Oyster River Watershed VRAP DATA. Oyster River Testing Committee. *Water Quality of the Oyster River, New Hampshire, 2001-2011.*2014.]

Table 27: Number of samples exceeding New Hampshire surface water quality standards in 2013

Site Name	DO (mg/L)	DO (% sat)	pH	Specific Conductance	E.coli	E. *coli* Geometric Mean
Standard	>6.0	>75% daily average	6.5-8.5	<835 µS/cmA	<153	<47
Caldwell Brook	1	-	7	-	1	1
Royalcrest	-	-	7	-	-	-
Route 125	5	-	7	-	-	1
Wheelwright	4	-	2	-	-	1
Lee Circle	5	-	7	-	2	1
Wendys Brook	-	-	1	4	4	1
Dube Brook	1	-	1	-	3	1
Route 155	-	-	-	-	2	1
Gaging Station	1	-	3	-	4	4
Mast Road	-	-	-	-	3	1
Chelsey Brook	-	-	-	-	-	-
Footbridge	-	-	-	-	-	1
Hamel Brook	3	-	1	-	-	1
College Brook	-	-	-	6	3	1
Pettee Brook	-	-	-	4	4	4
Stolworthy	-	-	-	-	-	-
Beards Creek	-	-	-	-	-	-
Johnson Creek	-	-	-	-	1	-

Note: Turbidity and water temperature are excluded in this table. Turbidity is measured as naturally occurring. There is no established water temperature standard.

[Source: NH DES Water Division. 2013 Oyster River Watershed VRAP Data.]

The water quality at most sites on the main stem of the Oyster River and on its tributaries appeared to be unimpaired or minimally impaired by human activity. Specific conductance values that exceeded the standard (835 µS/cmA) for the three tributaries (College Brook, Pettee Brook, and Wendys Brook) are displayed in the tables below. These values are typical of streams impacted by urbanization. E. *coli* exceedances for Wendys Brook are also shown below.

Table 28: Specific conductance exceeding standard (<835 <835 µS/cmA) on Oyster River tributaries

	College Brook	Pettee Brook	Wendys Brook
Date	Specific Conductance (µS/cmA)	Specific Conductance (µS/cmA)	Specific Conductance (µS/cmA)
5/18/2013	1431	1017	-
6/22/2013	1014	-	-
7/20/2013	1206	1136	895
8/24/2013	1478	-	1478
9/21/2013	1042	-	-
10/19/2013	1049	1020	843
11/16/2013	-	945	960

Table 29: E.*coli* exceeding standard (<153 CTS/100mL)

	Wendys Brook
Date	E. *coli* (CTS/100mL)
7/25/2013	4100
8/20/2013	640
9/19/2013	6100
11/21/2013	340

[Source: NH DES Water Division. 2013 Oyster River Watershed. VRAP Data.]

Water Quality Data: Nitrogen

Integrated Permitting Plan Study Data

As part of an effort to develop more cost-effective and sustainable means to meet future waste water treatment facility permitting compliance needs and improve water quality in the Oyster River watershed through an Integrated Permitting approach, the Town of Durham and UNH funded a Water Systems Analysis Group of the Natural Resources Department to conduct sampling using continuously recording nitrate sensors and data sources. This data supplements grab sampling data and provides information on how precipitation events influence nitrogen concentrations and loads both spatially and temporally.

As part of this effort, nitrate sensor data was collected from late April to early December, 2013 at several locations. Additional data was collected in 2014 to fill in flow data gaps and collected additional nitrogen concentration data. The results of this effort are anticipated to be available at the end of 2014.[40]

A summary of general findings of existing water quality data follows:

1. Sampling within the Oyster River main stem indicates relatively low nitrogen concentrations observed in the upstream headwater portions of the watershed and concentrations tend to increase in the middle sections between Route 155 and 155A near the Lee/Durham town line and then decrease again near the Mill Pond dam. The downstream decline may be due to denitrification processes occurring the Mill Pond.
2. Several tributaries tend to have relatively higher total dissolved nitrogen concentration and as a result higher estimated loads including College, Chesley and Reservoir (Pettee) Brook compared to other streams.
3. Streams with higher total dissolved nitrogen concentrations also tended to have elevated bacterial levels relative to other streams potentially caused by a nitrogen source related to animal or human waste.
4. Streams with more urbanized or developed watershed tend to have higher total dissolved nitrogen concentrations.
5. The continuous monitoring nitrogen and flow data currently being collected by the Water Systems Analysis Group will help to either refine or validate current nitrogen load estimates in select streams. This data is expected to be available by the end of 2014.[41]

Refer to the Oyster River Integrated Watershed Plan for Nitrogen Load Reduction report for recommended strategies and preliminary cost estimates for possible nitrogen control program to reduce nitrogen loading through:

- A lawn fertilizer program
- Agriculture management
- Impervious cover
- Existing septic systems
- Urine segregation or diversion
- Oyster bed restoration.

Piscataqua Region Estuaries Partnership (PREP) Monthly Sampling Data

Between 2008 and 2011, PREP collected over 43 monthly samples in the Oyster River main stem upstream of the Mill Pond Dam along Route 108. Table 30 displays a summary of the total dissolved nitrogen (TDN) analysis from these samples.

[40] Vanasse Hangen Brustlin, Inc. and Woodard and Curran Inc. *Oyster River Integrated Watershed Plan for Nitrogen Load Reductions.* July 2014.
[41] Ibid.

Table 30: Estimated nitrogen loads based on NH PREP monthly data from 2008-2011

Watershed Location	Estimated Drainage Area(ac)	Median Annual Flow (cfs)*	Mean Total Dissolved N Conc. (mg/L)q	Estimated Total Dissolved N (tons/yr)	Estimated Total N (tons/yr)	Percent of Total N Load
Oyster River at Mill Pond Dam	12,830	32.1	0.39	17.3	20.88	56%
Tidal Estuary Downstream of Dam	6,830	17.2	0.43	13.5	16.31	44%
Total Watershed	19,860	49.3	--	20.8	37.19	

*Median annual flow is based on the recorded annual flow during the 2008 to 2011 sampling period at the USGS Oyster River gauging station and not the entire historical record. The flow during this period was generally higher than the historical average flow over the long term records

[Source: Vanasse Hangen Brustlin, Inc. and Woodard and Curran Inc. *Oyster River Integrated Watershed Plan for Nitrogen Load Reductions.* July 2014.]

UNH Water Resources Research Center (WRRC)

The UNH Water Resources Center collected baseline nitrogen data at multiple locations throughout the watershed. The time period and sampling frequency for grab samples collected at various stations varied. Sampling data is summarized in the table below. For more information and a map of sampling site locations see *Oyster River Integrated Watershed Plan for Nitrogen Load Reductions*.

Table 31: Sampling information for stations in the Oyster River watershed by UNH WRRC

Stream	Station ID	Start Date	End Date	Sampling Frequency	Drainage Area	
					km²	acres
College Brook	CB02.2	5/17/2000	9/22/2006	Monthly	2.028	501
Chesley Brook	CB02	8/18/2009	8/15/2009	Bi-weekly 2003 with a few additional ORWA samples*	3.979	983
Dube Brook	DBE02	629/2002	8/15/2009	Bi-weekly 2003 with a few additional ORWA samples*	3.417	844
Johnson Creek	JNC03	8/18/2001	8/12/2009	Bi-weekly 2003 with a few additional ORWA samples*	5.414	1338
Littlehale Brook	LHB01	1/14/2003	12/19/2003	Bi-weekly 2003	0.907	224
Long Marsh Brook	LMB02	3/3/2003	12/19/2003	Bi-weekly 2003	1.271	314
Oyster River headwaters	OYS04	1/14/2003	12/19/2003	Bi-weekly 2003	11.747	2903
Pettee Brook	PB02.0	5/17/2000	9/30/2009	Monthly	2.542	628

[Source: Vanasse Hangen Brustlin, Inc. and Woodard and Curran Inc. *Oyster River Integrated Watershed Plan for Nitrogen Load Reductions.* July 2014.]

Flow-weighted mean concentrations for various nitrogen forms for each station based on the average daily discharge recorded on the day of sampling at the Oyster River gauging station are summarized in Table 32.

Table 32: Flow-weighted mean concentrations* for streams in the Oyster River watershed

Stream	Nitrate-N (NO_3) (mg/L)	Ammonium (NH_4) (mg/L)	Dissolved Inorganic Nitrogen (mg/L)	Dissolved Organic Nitrogen (mg/L)	Total Dissolved Nitrogen (mg/L)
College Brook	0.85	0.05	0.90	0.16	1.04
Chesley Brook	0.46	0.03	.048	0.28	0.76
Dube Brook	0.05	0.05	0.07	0.30	0.37
Johnson Creek	0.31	0.03	0.34	0.30	0.63
Littlehale Brook	0.29	0.04	0.33	0.14	0.47
Long Marsh Brook	0.07	0.03	0.10	0.25	0.35
Oyster River headwaters	0.05	0.04	0.09	0.20	0.29
Pettee Brook	0.40	0.08	0.48	0.23	0.68

*Flow-weighted mean concentrations were calculated using the average daily flow rate measured at the Oyster River gauging station on the day of sampling.

[Source: Vanasse Hangen Brustlin, Inc. and Woodard and Curran Inc. *Oyster River Integrated Watershed Plan for Nitrogen Load Reductions.* July 2014.]

Estimated total dissolved nitrogen and total nitrogen load estimates (lbs/ac/year) based on UNH's Water Resources Research Center sampling data from each subwatershed is displayed in Table 33. These load estimates were calculated by multiplying the flow-weighted mean concentrations by the median average annual runoff volume as measured by the Oyster River gage station and then area adjusted for each drainage area.[42]

Table 33: Estimated nitrogen loads (lbs/ac/yr) at each station based on the sampling data

Stream	DON (lbs/ac/yr)	DIN (lbs/ac/yr)	Total Dissolved Nitrogen (lbs/ac/yr)	Total Nitrogen (lbs/ac/yr)
College Brook	0.890	4.879	5.769	6.75
Chesley Brook	1.523	2.618	4.141	4.84
Dube Brook	1.633	0.374	2.007	2.35
Johnson Creek	1.622	1.844	3.465	4.05
Littlehale Brook	0.772	1.797	2.569	3.00
Long Marsh Brook	1.360	0.564	1.924	2.25
Oyster River headwaters	1.113	0.469	1.583	1.85
Pettee Brook	1.256	2.629	3.885	4.35
Note: Total dissolved N loads were calculated by multiplying the flow weighted mean concentration by the median agerage annual runoff volume (24 inches) based on gaging station data recorded between the years 200 and 2009. Total nitrogen loads were calculated based on TN to TCN ratio of 1.17 based on UNH WRRC data observed in the Lamprey River watershed.				

[Source: Vanasse Hangen Brustlin, Inc. and Woodard and Curran Inc. *Oyster River Integrated Watershed Plan for Nitrogen Load Reductions.* July 2014.]

[42] Vanasse Hangen Brustlin, Inc. and Woodard and Curran Inc. *Oyster River Integrated Watershed Plan for Nitrogen Load Reductions.* July 2014.

Water Withdrawals

The Oyster River is identified as highly significant water supply source. The Oyster River and its tributaries in Barrington, Durham, Lee, and Madbury are designated as Class A waters from their sources to the crest of the Oyster River Reservoir dam. All portions of the Oyster River downstream of this dam are designated Class B.[43]

Withdrawals

The University of New Hampshire maintains the only registered water withdrawal (>20,000 gallons per day or >600,000 gallons over any 30-day period) on the Oyster River. UNH and the Town of Durham utilize the Oyster River, along with the Lee Well and the Lamprey River as a public water supply. See Chapter III Resource Identification: Aquifers for more information about the Lee Well. UNH has six additional withdrawal permits within the watershed (Table 34).

Table 34: Withdrawals from the Oyster River (2013)

SD ID	Withdrawal	Avg. Daily Use (gals/day)	Adjusted Avg. Daily Use (gals/day)	Purpose	Location
Durham					
20066-S01	University of New Hampshire	153,549	373,637	Water Supply	Oyster River
From Major Tributaries to the Oyster River					
20066-S03	University of New Hampshire	280,001	280,001	Water Works	Lee 5 Corners Well
20830-S01	University of New Hampshire	77	77	Ritzman Lab	Ritzman Lab Well*
20694-S01	University of New Hampshire			Well	Cogeneration Electric Plant
20694-D01	University of New Hampshire			Irrigation (recharge)	Field House
20694-S02	University of New Hampshire	404	97	Well	Field House

[Source: Wayne Ives, NH DES from Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010, and NH DES. Onestop.]
*Voluntary reporting

New Groundwater Withdrawal Permit

The UNH/Durham Water System (UDWS) is currently in the process of applying for a new Large Withdrawal Permit. This permit is subject to the requirements of Env-Wq2101, *Water Conservation Rules.*

In accordance with RSA Chapter 485-C:61, applications for a new large groundwater withdrawal permit shall be based on demonstrated need for the withdrawal, and the need shall include a conservation management plan.

The UNH/Durham Water System (UDWS) has maintained a water conservation program for 10 years. UDWS created a comprehensive, adaptive plan in 2007 that operates within the boundaries of UDWS's Water Resource Management Plan. The comprehensive plan is currently being updated in association with the connection of a new groundwater

[43] Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.

source known as the Spruce Hole Well or UNH/Durham Production Well #2 (DGD-PW2) and installation of an artificial recharge facility located near the production well. This new overburden production well was installed in the winter of 2010 in what is known at the Spruce Hole Aquifer. When this well is connected to the distribution system in the fall of 2014 it will service both the Town and UNH.[44]

The well and artificial recharge will be used to: meet future water supply growth demands; meet peak summer and fall water demands; potentially reduce annual surface water treatment costs; and provide a redundant water supply source to help mitigate the potential loss of existing water supply sources and catastrophic failure of the surface water treatment plant.[45]

More information on the recharge project and permit is available on the Town of Durham's website: http://www.ci.durham.nh.us/towncouncil/spruce-hole-well-artificial-recharge-project-presentation-emery-garrett-groundwater.

Discharges

There are no registered surface water discharges to the river in the Oyster River watershed within the nominated section of the river, however, the Durham Wastewater Treatment Plant discharges wastewater to the tidal section of the river below the Mill Pond Dam. Water withdrawn from the Lamprey River is transferred to the Oyster River approximately 1 mile upstream from UNH's Arthur Rollins Water Treatment Plant (ARWTP).[46]

[44] Water Conservation Plan for the UNH/Durham Water System. July 2014.
[45] Underwood Engineers, Inc., and Emery & Garrett Groundwater, Inc. Development of a New Public Water Supply Well with Artificial Recharge, Spruce Hole Aquifer.
[46] Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.

Instream Flows

The Instream Flow Program was created by the New Hampshire Legislature in 1990 to ensure that rivers continue to flow in spite of the uses and stresses they incur due to human activity. Large withdraws of water directly from rivers for drinking and irrigation as well as from lakes and groundwater, the loss of wetlands, and dams that alter downstream flow can have significant impacts on river dynamics.

The purpose of the Instream Flow Rules (Chapter Env-Wq 1990) is to specify standards, criteria, and procedures by which a protected instream flow is to be established and enforced for each designated river segment in order to maintain water for instream public uses and to protect the resources for which the river or river segment is designated. There are two components of the program: 1) calculation of the flow conditions in a stream that will protect aquatic life, and 2) development of management plans that describe how water users will operate to maintain their water use needs along with the protected flow conditions, and how dam owners will manage their dams to maintain flow downstream. These management plans address: conservation; reducing the impacts of withdrawals; and prescribing a relief pulse of water.

Discharge data has been collected from the USGS Oyster River gage station since 1935. Both the annual average flow(20.3 cubic feet per second (cfs)) and annual peak flow of the Oyster River at this station have increased since the mid-1930s (Figures 11 and 12).

During this period of record, the highest average annual flow (37.5 cfs) occurred in 2006. The lowest annual average flow (8.9 cfs) occurred in 2002. Peak flow was exceptionally high in 1997 (1,160 cfs) and 2007 (1,320), likely due to large storm events. The high peak flow in 2007 represents a 265 percent increase compared with the average peak flow (361.4 cfs) from 1936-2013.[47]

Instream Flow Pilot Project

The Lamprey River and the Souhegan River were selected as pilot projects for the state's Instream Flow Program. The Water Management Plans for the Lamprey and Souhegan Rivers were adopted on August 30, 2013. After a 2-year period of implementation, the New Hampshire Legislature will review the pilot projects in 2015 to determine future actions pertaining to protected instream flow for the state's designated rivers.

Instream protected flows for the segments of the Lamprey River Designated as protected pursuant to RSA 483:15, XIII, which are based on comparing the timing and magnitude of the flow needs for fish, riparian vegetation, riparian wildlife, and human uses, are available at:
http://des.nh.gov/organization/divisions/water/wmb/rivers/instream/lamprey/documents/20110608lr-pisf-table1.pdf

Affected Water User

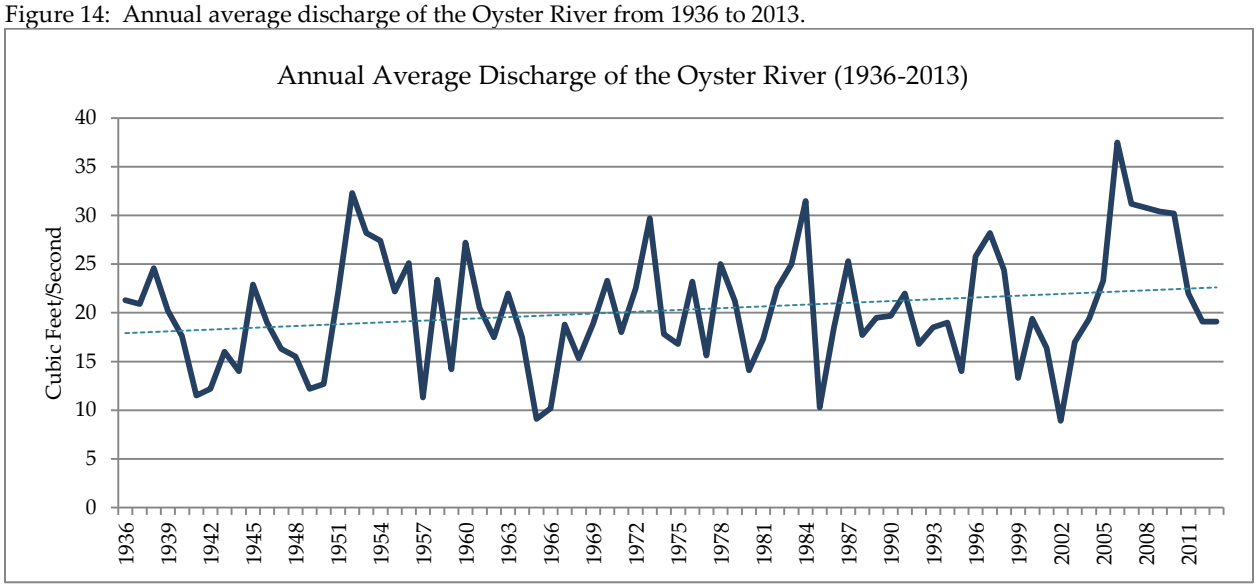
The UNH/Durham Water System (UDWS) is considered an Affected Water User under the Instream Flow Rules because one of its registered water sources is located on the Lamprey Designated River. Between 1970 and 2002, withdrawals from the Lamprey River supplemented the Oyster River supply source in time of drought. Withdraws were infrequent and made when demand was high and the available supply from the Oyster River was limited. After a direct connection was established between the Lamprey River and the ARWTP, more frequent water usage for trials and experimentation with the new system configuration from 2002-2004. From 2004-2008, withdrawals from the

[47] USGS National Water Information System: Web Interface. USGS 0107300 Oyster River Near Durham, NH.

Lamprey River were infrequent and sporadic. The Lamprey River became the principal source of water for the UDWS whenever flows at the Packers Falls station exceeded 45 cubic feet per second. The Oyster River was used when flows fell below this threshold.

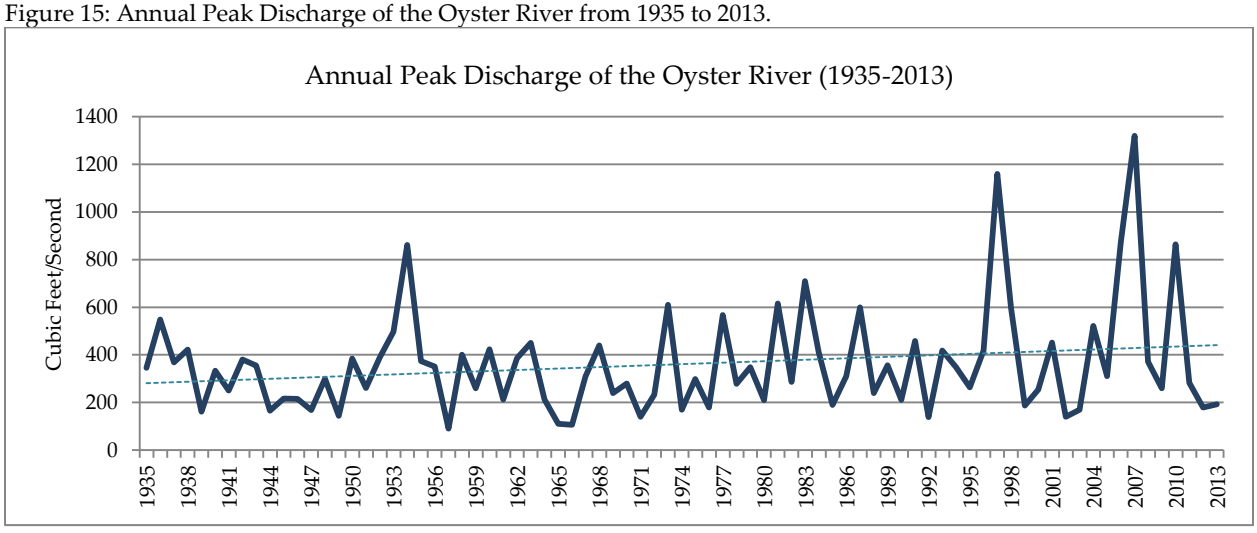
UDWS has the potential to manage water use to support the Protected Instream Flows due to the availability of multiple water sources and the potential for reducing water demand through the use of water conservation measures. The Oyster River reservoir is one alternative source of water. The reservoir has an estimated storage volume ranging from nine to 14.7 million gallons. The Oyster River watershed is more than ten times smaller than the Lamprey watershed and has less water available for consumptive use.

Figure 14: Annual average discharge of the Oyster River from 1936 to 2013.



[Source: USGS National Water Information System}

Figure 15: Annual Peak Discharge of the Oyster River from 1935 to 2013.



[Source: USGS National Water Information System]

Chapter V: Land Use Assessment

Assessment of Land Use in the River Corridor and Watershed

Land Use in the Corridor

Twenty percent of the land within the river corridor is developed. Residential land (12% of land within the corridor) accounts for the majority of developed land. There is scattered residential development along the river including a subdivision off Hall Road near the headwaters of the Oyster River. Between Mill Road and Route 108 in Durham there is medium and high density residential development.

Commercial and light industrial land is limited and located along Route 4 and Calef Road at the Lee traffic circle and along Route 4 in Barrington. Developed land use along the Oyster River in Durham is primarily residential. Undeveloped land accounts for 3,129 acres or 80% of the total area of the river corridor. Forested land accounts for nearly 60% of the land within the corridor.

Land Use in the Watershed

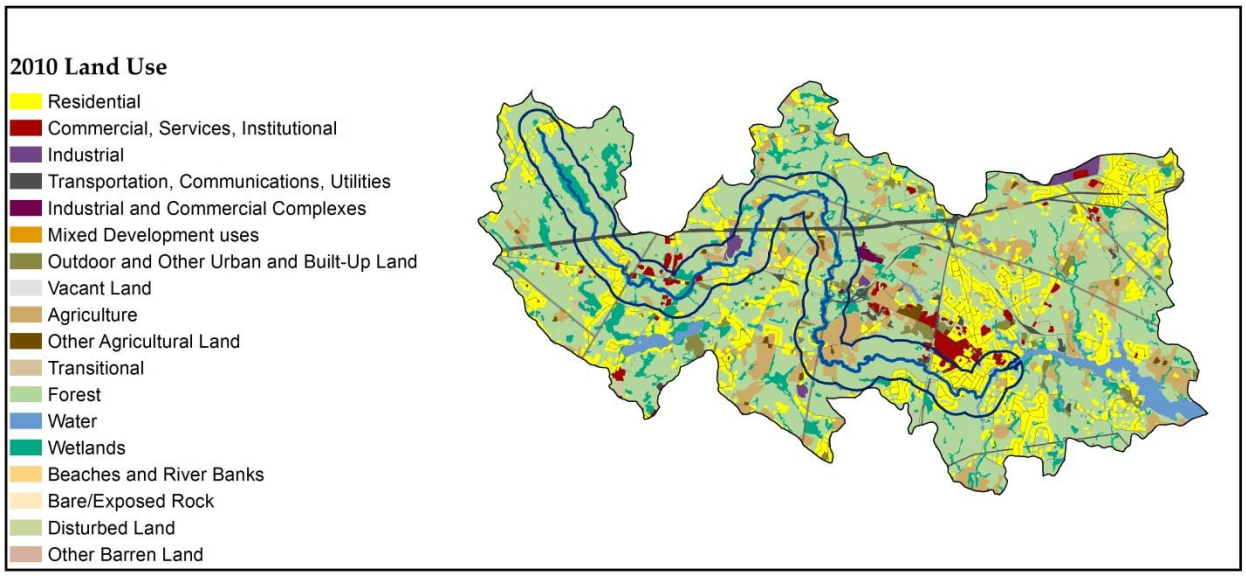
Approximately one fourth of the land within the watershed is developed land. Over half of developed land is residential. Approximately 55% of the total land within the watershed is forested. Agriculture accounts for approximately 8% of the watershed. Table 35 and Figure 16 display land use within the watershed. And corridor

Table 35: Land use within the river corridor and watershed

Land Use Type	Corridor		Watershed	
	Acres	Area (%)	Acres	Area (%)
Developed	**781.4**	**20.0**	**4,798.7**	**24.1**
Residential	499.9	12.8	3,184.1	16.0
Commercial, Services, and Institutional	71.1	1.8	334.5	1.7
Industrial	30.0	0.8	124.0	0.6
Transportation, Communications, and Utilities	132.1	3.4	765.7	3.9
Industrial and Commercial Complexes	1.6	0.0	28.7	0.1
Mixed Development Uses	-	-	3.4	0.0
Outdoor and Other Urban and Built-Up Land	46.7	1.2	357.9	1.8
Vacant Land	-	-	0.4	0.0
Undeveloped	**3,128.7**	**80.1**	**15,076.5**	**75.9**
Agriculture	300.3	7.7	1,675.2	8.4
Transitional	38.6	1.0	192.1	1.0
Forest	2,285.6	58.5	10,915.1	54.9
Water	41.1	1.0	533.5	2.7
Wetlands	406.2	10.4	1,502.5	7.6
Barren	56.9	1.5	258.1	1.3
TOTAL	**3,910.1**	**100.0**	**19,875.2**	**100.0**

[Source: NH GRANIT- 2010]

Figure 16. Land use within the watershed



[Source: NH GRANIT]

Infrastructure Crossings

There are a total of 13 bridge crossings over the Oyster River, including eight state highway crossings (Table 36). Utility lines cross the Oyster River in Three locations: a) approximately ¼ mile north of Route 4 in Barrington, b) between Old Mill and Snell Road in Lee, and c) North of Demerrit Hill Farm and Madbury-Lee Road in Lee.

Table 36: Bridges of the Oyster River Corridor

Community	Total	Private-Local	State Highway
Barrington	1	0	1
Durham	6	3	3
Lee	6	2	4
Madbury	-	-	-
Total	13	5	8

[Source: NH Department of Transportation]

Master Plan Language

The importance of the Oyster River as a community resource is reflected in the local planning and protection efforts of the communities along the river. The Towns of Durham, Lee, Madbury, and Barrington recognize the river throughout each community Master Plan. The following Master Plan language for each community was summarized in the Oyster River Nomination and demonstrates the river's significance to each community.[48]

Town of Barrington Master Plan

(a) The Oyster River originates in Barrington in the vicinity of Creek Pond, south of Swains Lake. The Oyster River flows east 13 miles to Little Bay at Durham Point. The major surface water features of the watershed are the river,

[48] Oyster River Watershed Association and Strafford Regional Planning Commission. *Oyster River Nomination*. 2010.

Wheelwright Pond, and Durham Reservoir. Other features include Caldwell Brook in Barrington. The maximum elevation in the watershed is 300 feet near Swain's Lake.
(b) The Oyster River Watershed Association as part of the NHDES Volunteer River Assessment Program (VRAP) has conducted water quality sampling over the years. The result of the monitoring support the upper reaches of the Oyster River as Class A water.

Strategic Objectives

1. The Town of Barrington should endeavor to protect and enhance key natural resources in the community that define the town's rural character such as scenic vistas, river corridors, lakes and ponds, woodlands, fields and farmland.

2. Promote the preservation of large tracts of unfragmented open space that provides important wildlife habitat and offers opportunities for traditional recreation activities such as hunting, fishing, and hiking.

3. The Town should evaluate alternatives for determining the existing condition of key environmental attributes within Barrington (especially lakes, ponds, and rivers) and then periodically monitor these sites over time to determine any changes in quality or possible source of degradation.

Town of Durham Master Plan

4.2 Surface Water and Estuarine Resources
(a) The Town of Durham contains three primary watersheds: the Oyster River watershed, the Crommet Creek/Great Bay watershed, and the Lamprey River watershed. Durham has a major responsibility in managing these three watersheds. How the watersheds are managed defines the health of both Great and Little Bays. Stormwater runoff, wastewater management, and identification and control of point source contaminants all impact the environmental health of the Great and Little Bay estuarine systems.
(b) Despite Durham's investment in bringing secondary treatment capability to its Wastewater Treatment Plant, the sanitary sewer system remains a significant concern with respect to the discharge of nutrients and coliform bacteria into the Oyster River. A study of the fecal coliform levels of all the tributary rivers for the Great Bay from 1993 through 1996 found that the freshwater portion of the Oyster River has the second highest coliform levels under wet conditions (300 units/100 ml), behind the Cocheco River. The levels are such that they are well in excess of the safe levels for shellfishing and also exceed the levels acceptable for State recreational waters. There are many factors that can contribute to this high level of coliform bacteria, but one of the likely sources is inflow and infiltration from sewer pipes.

Goals and Recommendations
1. Ensure that septic systems and the Durham wastewater treatment plant are operated and managed to minimize any and all adverse effects on the water quality of the bays and the tributaries that feed the bays.

As part of the Town's renewal of the Wastewater Treatment Plant's discharge permit, improvements in the plant's technology should be made to improve the water quality in the Oyster River and Great/Little Bays.

2. The Town should provide for comprehensive protection of the wetlands and shoreland through regulatory, educational, and voluntary efforts.

When updating the Town's current ordinances with respect to wetland and shoreland buffers, the criteria established in *Buffers for Wetlands and Surface Waters: A Guidebook for New Hampshire Municipalities* should be used as a primary reference. Areas for which larger buffers may be warranted over the standard buffer recommended by the State include: Johnson Creek, Little Bay, Great Bay, Lamprey River, Oyster River, Bunker Creek, Wagon Hill/Tirrell marshes. These areas have been identified as sensitive resources through the NH Coastal Method and other studies.

3. The Town of Durham should update its ordinances and regulations to adequately address the issues of stormwater management, erosion, and sediment control. The Town should also review and upgrade its stormwater facilities to improve the water quality of the Great Bay estuary.

The Zoning Ordinance should strive to keep impervious surface below 15% within each of the primary estuarine tributary watersheds for the Great and Little Bays. The primary estuarine watersheds within Durham for the Great and Little Bays are as follows: Lamprey River, Crommet Creek, several creeks in the vicinity of Colony Cove, Oyster River, and Bellamy River.

44.9 Drinking Water and Aquifer Protection

(a) Durham's municipal water supply comes from a combination of wells drawing from this sand and gravel aquifer and directly from the Lamprey and Oyster Rivers. A regional approach to the management of this asset is essential since activity in Lee, Madbury, and Newmarket will affect the same resource that is utilized by Durham and those communities.

Lands which are presently identified as important in the 1989 Master Plan do not adequately provide drinking water resource protection. That is because there are no sand and gravel deposits in the area of the greenway, and there is no water source with the potential necessary to sustain a municipal water supply.

Goals and Recommendations

1. Drinking water resource protection is currently done on a community-by-community basis, while the resource transcends political boundaries.

The adequacy of the drinking water resource must be assessed in reference to the regional demands on the resource. The Town of Durham's needs for this resource cannot be effectively considered in isolation to the projected demands of the adjacent towns and the University of New Hampshire. The in-flow characteristics of the Lamprey and Oyster Rivers needs to be assessed. The sovereign exemptions of the municipalities and the University must not limit protective measures.

4.22 Urban Service Area Greenways

(a) The Oyster River is a historic connection with the Great Bay communities and provides a tangible physical connection to Little Bay, Great Bay, and the Piscataqua River. The Oyster River is a visible link to Durham's history as a vital colonial center and thus it is the centerpiece of the urban service area greenway.

Goals and Recommendations

1. Create an urban service area greenway system that is based upon the major streams and rivers within the core – College Brook, Beards Creek, Oyster River, Littlehale Creek, Pettee Brook, and Reservoir Brook. Although the greenway system will serve primarily as a resource protection measure, pedestrian connections should be aggressively pursued by working with willing landowners. The greenway system should also be linked by offroad bike and pedestrian trails/Class VI Highways, such as the Wagon Track Trail.

College Brook should be restored in those areas where it has experienced degradation. The Mill Pond and adjacent wetlands should be enhanced as a demonstration of the importance of greenway extensions into the downtown core. Enhancement of foot paths and passive recreational use of this area should be encouraged for the benefit of those living in the immediate neighborhood and to enhance the vision of Durham's special relationship with its fresh- and saltwater bodies. Sightings of rare and endangered species have been recorded in the College Brook greenway and Mill Pond area. The fact that unusual and important wildlife sightings can take place immediately adjacent to the Town's commercial core is of great importance to the sense of the Town of Durham as a place where modern presence can exist in concert with nature.

4.34 Historic and Archaeological Resources

(a) Durham has a complex past with nearly four hundred years of predominantly Western European settlement, preceded by thousands of years of an aboriginal presence. The pre-historic antecedent to the European presence

extends to the last ice age, but is now present only in the archeological record. There is a great deal of documentation of the relationships between the European settlers and the Native American population.
(b) Durham's abundant history is shown by the numerous historic sites and markers present within the community. An archeological inventory of Durham exists at the Division of Historical Resources (DHR) in Concord; however, the DHR has a policy of not releasing this information to protect landowners from trespassing and the resources from illegal takings.

Goals and Recommendations
1. Provide Durham residents with a broader historical knowledge of their community to include pre-Colonial history and the archeological resources in the community.

Durham's historic orientation to the Oyster River, Great Bay, and Little Bay should be emphasized to highlight the vital importance of these waterways in the development of commerce and transportation and the present-day importance of these waterways with our relationship to our sister seacoast communities. This could be done through both a pamphlet and historic marker signs.

Town of Lee Master Plan

V.8 Trails System

(a) The Lee Forest Complex, which covers almost 200 acres, running from the bog behind the Library to the shore of Wheelwright Pond, provides a very helpful addition to the idea of a "livable, walkable community" by means of the several walking paths that wind throughout the area. The system of trails has been developed over the years through a combination of scout projects and cooperation by a number of volunteers. There is a total of over 3 miles of walking trails on Town-owned land in this area. There are several points where the trails can be accessed from easily available locations. In addition to the Town Forest Complex, there are other Town-owned lands that also have walking trails on them. They include:

- James Farm, accessible from the pond along the James Farm loop road
- Little River Reserve, accessible from Cartland Road
- Maud Jones Memorial Forest and Tree Farm, accessible from Garrity Road
- Oyster River Reserve, accessible from Route 155A (Old Concord Turnpike)

Goals and Recommendations
1. Establish a low impact, interconnecting system of trails to link the neighborhoods with the Town Center of Lee to enhance the history, transportation options, and healthy quality of life of the town.

Link the trails of the Lee community to existing trail systems within the surrounding towns of Madbury, Durham, Epping, Nottingham, and Barrington.

Establish a Lee Trails Committee to actively promote the design and use of a community trail system, encouraging safety in recreation activities along roads and trails, such as biking, hiking, horseback riding, bird watching, fishing, cross country skiing, and jogging.

VI.1 Water Resources

(a) The Lamprey, Oyster, Little, and North Rivers comprise the main streams in the Town of Lee. The Oyster River, Chesley Brook, and Dube Brook are the main sources of municipal water for the Durham Reservoir.

Goals and Recommendations
1. Conserve and protect the integrity of the Town's watersheds and surface water resources in their quality, quantity, and their intrinsic scenic and wildlife habitat values.
2. Determine the drinking water quality and quantity deficiencies in the local water supplies.

3. Define the future water resource needs of the community and consider developing Town-owned water supplies.
    (a) Develop and implement a Water Resource Management and Protection Plan.
    (b) Continue to develop and maintain a Town database of water wells and water quality.
    (c) Perform regular voluntary surveys of residential and community wells
    (d) Evaluate the future demand on existing water resources and the potential need for future Town owned water supplies.

Town of Madbury Master Plan

2.2 Water Resources

(a) The protection and use of water resources are critical concerns to the Town of Madbury. With virtually all residents dependent upon private wells for domestic use, the quantity and quality of available groundwater must be protected from depletion and contamination. Other Town water resources, such as swamps, ponds, streams, and wetlands are important because they are hydrologically related to groundwater, and provide ecological, scenic, and recreational value to residents.

Goals and Recommendations
1. Madbury has a policy statement to vigorously protect water resources from contamination, depletion, and visual disfigurement. Act as stewards for municipal and regional water supplies located within the Oyster River, Bellamy River, and Little Bay watersheds.
Support the efforts of watershed associations, regional planning commissions, and municipalities to coordinate water protection and management within the Bellamy and Oyster River watersheds.

Take reasonable and prudent precautions to protect all water resources from incompatible land uses, thus protecting the health and general welfare of the community.

Insure that sufficient water supplies exist for use by Madbury residents, as well as native wildlife and plant communities. The Town needs to examine and address water supply issues, watershed management, pollution, and potential aquifers/gravel areas.

2.3 Natural Resources
(a) Madbury straddles the boundary of the Oyster River and Bellamy River Watersheds. Consequently, anything that affects surface water characteristics within town boundaries potentially affects all downstream areas in two watersheds, both of which contain critical wetland habitat and extremely important water sources for people in Madbury and in surrounding communities.

Goals and Recommendations
1. Protection of water resources through the use of a wetlands conservation overlay zone applied to salt marshes, wetlands, and surface water (ponds, first order streams, headwaters) is a priority of the Town to be enforced by the Planning Board.
- Consider placing mandatory conservation easements on wetlands within subdivisions. Use the Town of Lee as a model.
- Consider providing stricter protection of the ecological services of wetlands, such as filtration.
- Officially designate prime wetlands for Madbury.
- Protect water supplies around wells and rivers, possibly through establishment or upgrade of ordinances, such as wellhead protection districts, well recharge areas, aquifer protection districts, and substantial riparian setbacks for water conservation.

Local Zoning Districts and Use Regulations

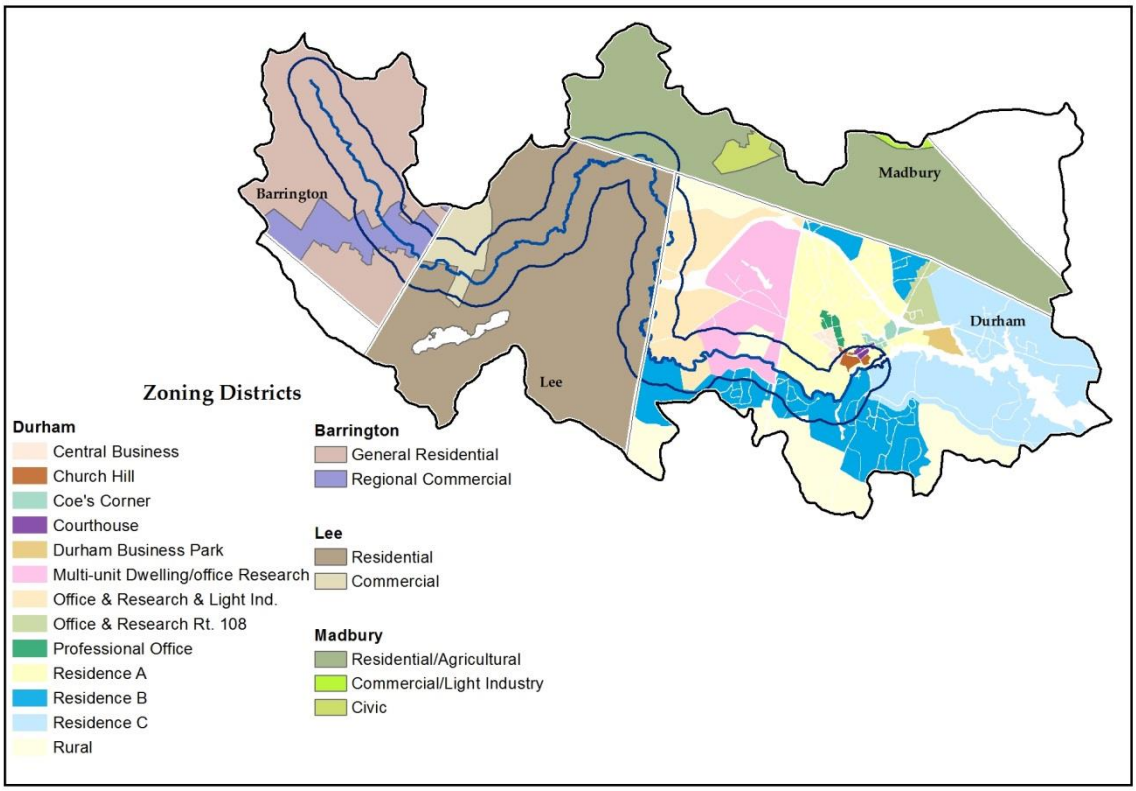
Approximately 75% of both the watershed and the river corridor are zoned for residential, rural, and agricultural uses. Commercial, light industrial, and urban zoning accounts for 15% of the area of the watershed and 25% of the area of the corridor. The table and map below display zoning districts and the area of each district in the watershed by community.

Table 37: Area of zoning districts in the watershed by community

Community	Zoning District	Corridor		Watershed	
		Acres	Area (%)	Acres	Area (%)
Barrington	General Residential	702.9	18.0	2390.2	12.0
	Regional Commercial	177.1	4.5	489.3	2.5
Durham	Residence A – High Density	177.0	4.5	1045.7	5.3
	Residence B – High Density	360.4	9.2	1308.9	6.6
	Residence Coastal Density	34.6	0.9	1637.2	8.2
	Rural District	82.5	2.1	1167.7	5.9
	Central Business District	4.5	0.1	38.8	0.2
	Church Hill	26.0	0.7	28.5	0.1
	Coe's Corner	0.1	0.0	48.5	0.2
	Courthouse	11.5	0.3	13.5	0.1
	Professional Office	0.0	0.0	33.3	0.2
	Multi-Unit Dwelling/Office	181.9	4.7	815.6	4.1
	Business Park	0.0	0.0	54.0	0.3
	Office & Research – Rte 108	0.0	0.0	134.6	0.7
	Office & Research – Light Industry	419.8	10.7	837.2	4.2
	Water	33.0	0.8	362.0	1.8
Lee	Residential	1393.5	35.6	4342.7	21.8
	Commercial	154.5	4.0	314.8	1.6
	Water	0	0.0	102.3	0.5
Madbury	Residential-Agricultural	150.8	3.9	3164.8	15.9
	Commercial & Light Industrial	0	0.0	33.0	0.2
	Civic (assembly/office)	0	0.0	122.9	0.6
Zoning District Totals by Type					
Residential		572.0	14.6	3,991.7	20.1
Residential/Agricultural/Rural		2,329.7	59.6	11,065.4	55.7
Commercial/Light Industrial/Mixed/Urban		975.4	24.9	2,961.2	14.9
Water		33.0	0.8	464.3	2.3
Note: 1,399 acres (7.0%) of the watershed falls in Dover and Nottingham and are included in the total area of the watershed.					

[Source: SRPC Communities, 2014]

Figure 17. Zoning districts of communities within the corridor



[Source: SRPC Communities, 2014]

Environmental and Resource Based Overlay Districts

A number of local zoning requirements and overlay districts apply to the Oyster River and its corridor and watershed.

Town of Barrington – Zoning Ordinance

Wetlands Protection District Overlay – Article 9.1

The general purpose of this District is to preserve and protect the many wetland areas in Barrington for the benefit of public health, safety and welfare. The intent of this section is to restrict the use of wetland areas and their buffers to promote the following goals: 1) Prevent the pollution of surface waters and groundwater; 2) Prevent the dewatering of wetlands; 3) Prevent adverse impact to wetlands that provides flood protection, recharge of groundwater supply, augmentation of stream flow during dry periods, habitat for plants, fish or wildlife, or commerce, recreation or aesthetic enjoyment; and 4) Permit those uses that can be appropriately and safely located in wetlands and their buffer areas.

Shoreland Protection District Overlay – Article 11.1

The purpose of the Shoreland Protection District is to preserve the overall quality of surface waters, and their adjacent environs, in the Town of Barrington in order to protect the public health and maintain the ecological integrity associated with these resources. More specifically, the intent of the regulations established in this Article are: 1) Maintain the quality of surface waters to insure protection of groundwater and drinking water supplies; 2) Conserve and protect the aquatic and terrestrial habitat associated with the town's rivers, lakes and ponds; and 3) Preserve and enhance the aesthetic values associated with shoreline areas in order to maintain the town's rural

character; and 4) Encourage those uses that can be appropriately located adjacent to the town's surface water resources.

Groundwater Protection District Overlay – 12.1

In the Town of Barrington, where water is drawn almost exclusively from wells, the protection of groundwater and the capability to recharge this water supply are issues of town-wide importance. Therefore, the intent of the Groundwater Protection District is to address the need to protect, preserve, and maintain groundwater resources within the town. The establishment of these regulations is also intended to address the following specific issues: 1) Protect the public health and general welfare of the citizens of Barrington; 2) Prevent development and land use practices that would contaminate or reduce the recharge of the groundwater supplies and aquifers; 3) Provide for future growth and development of the town, in accordance with the Master Plan, by ensuring the future availability of public and private water supplies; and 4) Encourage uses that can appropriately and safely be located in the groundwater and aquifer recharge areas.

Town of Durham – Zoning Ordinance

Wetland Conservation Overlay District – Article 13

The Wetland Conservation Overlay (WCO) District is an overlay district intended to protect the quality and functioning of wetlands through the Town by managing the use of the wetland and upland buffer adjacent to the wetland in coordination with the state dredge and fill permit system. The provisions in this article are intended to: 1) Protect the water quality of wetlands by appropriately managing stormwater runoff, siltation and sedimentation, and the construction of alteration of allowed or pre-existing buildings and structures; 2) Minimize flooding and flood damage by preserving the flood storage capacity of wetlands; 3) Protect wildlife and fisheries habitats and wetlands vegetation; 4) Maintain stream flow and groundwater recharge; 5) Conserve natural beauty and scenic quality; and 6) Limit uses of the wetland and upland buffer to those that are consistent with the objectives.

Shoreland Protection Overlay District – Article 14

The Shoreland Protection Overlay (SPO) District is an overlay district intended to protect the quality of the Town's surface waters in order to promote health and safety, maintain wildlife habitat, and conserve and protect shoreline and upland resources. The district is intended to implement and expand upon the provisions of the Comprehensive Shoreland Protection Act, NH RSA 483-B. The provisions of this article are intended to: 1) Protect the water quality of Great and Little Bays, the Oyster and Lamprey Rivers, and the Town's other surface waters by managing stormwater runoff, siltation and sedimentation, and the construction or alteration of buildings and structures in proximity of these resources; 2) Minimize the potential for the pollution of these water bodies; 3) Protect wildlife and fisheries habitats and travelways; 4) Conserve the natural beauty and scenic quality of the shoreland; and 5) Allow uses of the land adjacent to these water bodies that are consistent with these objectives.

Aquifer Protection Overlay District – Article 16

The Town of Durham adopts an Aquifer Protection Overlay District and accompanying regulations in order to protect, preserve and maintain existing and potential groundwater supplies and related groundwater recharge areas within the town. The objectives of the Aquifer Protection Overlay District are: 1) Protect the public health and general welfare of the citizens of Durham; 2) Prevent development and land use practices that could potentially contaminate or reduce the rate of recharge of identified aquifers; 3) Provide for future growth and development of the town, in accordance with the Master Plan, by ensuring the future availability of safe public and private water supplies; 4) Permit uses that can appropriately and safely be located in the aquifer recharge areas.

Town of Lee – Zoning Ordinance

Aquifer Conservation District – Article 13

The purpose of this article is to protect the public health, safety and general welfare by providing for the protection and preservation of existing and potential groundwater resources, known as aquifers, in the Town of Lee, New Hampshire. The intent of this article is to protect our known aquifers by preventing adverse land use practices and by limiting the kinds of development which are inconsistent with the preservation of potable groundwater supply. This district will be managed in the interest of providing water of acceptable quality and adequate quantity for the

use by present and future generations of Lee residents. The Aquifer Conservation District is identified as those areas depicted on the Lee Zoning Map, which are designated as having the potential to yield groundwater.

Shoreland Conservation District – Article 14

The intent of this district is to protect water quality, visual character and the wildlife habitat of the Shoreland areas. The Shoreland Conservation District shall be all land located one hundred (100) feet of the shores of the Lamprey River, Little River, North River, Oyster River, Dube Brook, Chesley Brook and Wheelwright Pond.

Wet Soils Conservation Zone – Article 15

Includes those areas such as swamps, marshes, and bogs that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support prevalence of vegetation for life in saturated soil conditions. The limits of the Wet Soils Conservation Zone are hereby determined by the areas subjected to high water tables for extended periods of time and includes, but are not necessarily limited to all such areas delineated as Wet Soils on the current Town of Lee Wet Soils Map, which is on file in the Office of Planning and Zoning.

Town of Madbury – Zoning Ordinance

Wet Area Conservation Overlay District – Article 9

The purpose of this article is to implement Madbury's adopted Master Plan's first priority policy goal to "Protect and manage…wetlands…for the benefit to present and future generations." and "Protect water resources in Madbury from contamination, depletion and disfigurement using watershed management principles." In support of these goals, this article will help to: 1) Prevent the pollution of surface water and ground water by controlling the development of structures and land uses on naturally occurring wetlands; 2) Prevent the destruction of natural wetlands that provide flood protection and stormwater storage, recharge of ground water supply, and augmentation of stream flow during dry periods; 3) Protect presently existing natural wetland wildlife habitat; 4) Prevent any inharmonious use of wetlands that would cause excessive or untimely expenses or environmental degradation to the Town; and 5) Accommodate those uses that can be appropriately and safely located in a wetland.

Aquifer and Wellhead Protection Overlay District – Article 9A

The purpose of this article is to implement the adopted Town of Madbury Master Plan priority objective to: "Protect water resources in Madbury from contamination, depletion and disfigurement using watershed management principles. Act as stewards for municipal and regional water supplies located within the Oyster River, Bellamy River, and Little Bay watersheds." Clean and abundant water from Madbury's ground water aquifers is necessary for the health, welfare, safety and prosperity of the Town and its surrounding area. Wells serving public water systems are critical resources. This article provides protections for these essential resources from risks associated with adverse land use and development.

Shoreland Protection Overlay District – Article 10

The purpose of this article is to implement Madbury's adopted Master Plan's first priority goal: "Protect water resources in Madbury from contamination, depletion and disfigurement using watershed management principles" and "Act as stewards for municipal and regional water supplies located within the Oyster River, Bellamy River, and Little Bay watersheds." In support of these goals, this article will help to: 1) Preserve and maintain surface water quality in Madbury; 2) Conserve and protect aquatic and terrestrial habitat associated with inter-tidal and riparian areas; 3) Preserve and enhance those aesthetic values associated with the natural shoreline; and 4) Encourage those uses that can be appropriately located adjacent to the shorelines.

Additional Regulations

The following table summarizes additional local regulations compiled by the Piscataqua Region Estuaries Partnership.

Table 38: Summary of additional local regulations

	Barrington	Durham	Lee	Madbury
Water Resource Management Plan in Master Plan	No	No	Yes	Yes
Wetland Ordinance	Yes	Yes	Yes	Yes
Erosion and Sediment Control Ordinance	No	No	No	No
Stormwater Ordinance	No	No	No	No
Stormwater Regulations within Zoning Ordinance	No	No	No	Yes
Stormwater Regulations within Site Plan Regulations	Yes	Yes	Yes	No
Stormwater Regulations in Subdivision Regulations	Yes	No	No	Yes
Wellhead Protection Regulations	Yes	No	No	Yes
Aquifer Protection Regulations	Yes	Yes	Yes	Yes
Note: see the PREP Environmental Planning Assessment for more information				

[Source: Piscataqua Region Estuaries Partnership, 2009]

Minimum Lot Size

State Requirements

The minimum size for new residential development lot size in areas dependent upon on-site septic systems shall be determined by soil type lot size determinations, as established by the NH DES under RSA 485-A and rules adopted to implement it. For non-residential development, the minimum lot size in areas dependent upon on-site septic systems shall be determined by soil type lot size determinations, as set forth under rules adopted under RSA 541-A. For both residential and non-residential development in the protected shoreland, no lot having frontage on public waters shall be created with less than 150 feet of shoreland frontage.

Local Requirements

Minimum lot size requirements vary widely by community and by zoning district. Lot size requirements by community and zoning district are summarized in the table below.

Table 39: Minimum lot size for local zoning districts in the watershed by community

Community	Zoning District	Minimum Lot Area
Barrington	General Residential	80,000
	Regional Commercial	40,000
Durham	Residence A – High Density	20,000
	Residence B – High Density	40,000
	Residence Coastal Density	150,000
	Rural District	150,000
	Central Business District	5,000
	Church Hill	5,000
	Coe's Corner	30,000
	Courthouse	5,000
	Professional Office	10,000
	Multi-Unit Dwelling/Office	40,000
	Business Park	40,000
	Office & Research – Rte 108	40,000
	Office & Research – Light Industry	40,000

Lee	Residential	85,000
	Commercial	85,000
Madbury	Residential-Agricultural	80,000
	Commercial & Light Industrial	80,000
	Civic (assembly/office)	80,000

[Source: Barrington, Durham, Lee, and Madbury Zoning Ordinances]

Permitted Uses

The table below describes the general uses permitted within the zoning districts in the watershed. Several communities may allow additional uses by grant of a Special Exception from the Zoning Board of Adjustment.

Table 40: Permitted uses for zoning districts in the watershed by community

Zoning District	Permitted Uses
	Barrington
General Residential	Low density residential development in traditional subdivisions; cluster subdivisions permitted to encourage preservation of natural resources and open space; regulations promote continuation of the historical land development patterns that were identified in the 2004 Master Plan; regulations allow for small-scale business uses or establishments, only if such uses are operated in conjunction with residential uses and developed in compliance with specific standards
Regional Commercial	Commercial and industrial land uses that conform to the development goals identified in the 2004 Master Plan; limited residential development permitted but are considered less appropriate for the land area immediately adjacent to the roadway corridor; relatively small amount of land remaining along Route 125 and Route 4 corridors should be reserved primarily for non-residential uses; commercial and industrial development in accordance with the site design guidelines presented in the master Plan that recommend a compact, nodal form of development
	Durham
Residence A – High Density	High density residential area that are predominantly served by public water and sewerage; new development, redevelopment, expansions of existing buildings and structures are consistent with and maintain the established character of the neighborhoods; conservation activities; forestry; temporary sawmill; single-family residence; elderly housing, single family; elderly housing, duplex, elderly housing, multiunit; house occupation (first class); accessory structure; accessory agricultural activities; accessory animal husbandry poultry and livestock; accessory apartment; child care home for not more than six children; child care home for more than six children; adult day care facility; government facility; recreational playing fields, outdoor; personal wireless service facility; bed & breakfast; accessory buildings and structures; off street parking on the lot to serve the allowed use; surface parking
Residence B – High Density	Medium-density residential areas; new development, redevelopment, expansions of existing buildings and structures are consistent with and maintain the established character of the neighborhoods; conservation activities; forestry; temporary sawmill; single-family residence; elderly housing, single family; elderly housing, duplex, elderly housing, multiunit; house occupation (first class); accessory structure; accessory agricultural activities; accessory animal husbandry poultry and livestock; accessory apartment; child care home for not more than six children; child care home for more than six children; nursery or pre-school; government facility; recreational playing fields, outdoor; personal wireless service facility; bed & breakfast; accessory buildings and structures; off street parking on the lot to serve the allowed use; surface parking
Residence Coastal Density	Development preserves the natural and scenic environment of the district; residential development limited to housing that is designed so that the character of the district is

Zoning District	Permitted Uses
	maintained, the scenic quality of coastal areas is protected and a significant amount of open space is permanently preserved; conservation activities; forestry; temporary sawmill; single-family residence; elderly housing, single family; elderly housing, duplex, elderly housing, multiunit; elderly facility; home occupation (first class0; home occupation (second class0; accessory structure; accessory agricultural activities; accessory animal husbandry poultry and livestock; accessory apartment; accessory dwelling unit; child care home for not more than six children; child care home for more than six children; adult day care; child care center or nursery; nursery or pre-school; government facility; recreational playing fields, outdoor; personal wireless service facility; bed & breakfast; inn; gallery; accessory buildings and structures; off street parking on the lot to serve the allowed use; surface parking
Rural District	Rural, low density, not served or intended to be served by public water and public sewerage; rural and agricultural heritage should remain preserved; customary rural land uses preserved and all development carried out with the objective of preserving the natural and scenic environment of the district; conservation activities; forestry; temporary sawmill; single-family residence; elderly housing, single family; elderly housing, duplex, elderly housing, multiunit; manufactured housing; elderly facility; home occupation (first class); home occupation (second class); accessory structure; accessory agricultural activities; accessory animal husbandry – livestock and poultry; accessory apartment; accessory dwelling unit; child care home for not more than six children; child care home for more than six children; adult day care; child care center or nursery; adult day care; child care center or nursery; nursery or pre-school; government facility; recreational playing fields, outdoor; personal wireless service facility; bed & breakfast; inn; gallery; accessory buildings and structures; off street parking on the lot to serve the allowed use; surface parking
Central Business District	Mixed use, pedestrian-oriented character; mixed use developed in which the upper floors are used for residential purposes is encouraged; conservation activities; accessory apartments; child care home for not more than six children; child care home for more than six children; adult day care facility; child care center or nursery; nursery or pre-school; club; community center; government facility; library; museum; personal wireless service facility; reuse older single-family residence for a low impact nonresidential use; hotel; restaurant; restaurant, carry-out; craft shop with accessory production; gallery; retail store; retail store limited; financial institution; business services; medical clinic; cinema; theater; personal services; office, business; office, professional; repair services; accessory buildings and structures; off street parking on the lot to serve the allowed use; structural parking; surface parking
Church Hill	Multiple land uses including professional offices, limited retail uses, and apartments; adaptive reuse encouraged including the use of first floor space for non-residential use while the upper floors are residential; reuse of existing buildings bound by the standards of the Historic Overlay District provisions; conservation activities; residence, single-family; elderly housing, single family; elderly housing, duplex; elderly housing multiunit; eldercare facility; nursing home; home occupation (first class); accessory structure; accessory apartment; accessory dwelling unit; child care home for not more than six children; child care home for more than six children; adult day care facility; art center; government facility; library; museum; religious use/facility; personal wireless service facility; reuse older single-family residence for a low impact nonresidential use; restaurant; craft shop with accessory production; gallery; retail store limited; office, business; office, professional; manufacturing, light; caretaker apartment within a non-residential use; accessory buildings and structures; off street parking on the lot to serve the allowed use; structural parking; surface parking
Coe's Corner	Transition zone with controlled commercial development; high-quality office and hospitality uses; conservation activities; forestry; elderly housing, single family; eldercare facility; nursing home; home occupation (first class); home occupation (second class); accessory structure; accessory apartment; accessory dwelling unit; child care home for not more than six children; child care home for more than six children; adult day care facility;

Zoning District	Permitted Uses
	government facility; library; personal wireless service facility; reuse older single-family residence for a low impact nonresidential use; conference center; office, business; office, professional; manufacturing, light; accessory buildings and structures; off street parking on the lot to serve the allowed use; structural parking, surface parking
Courthouse	Variety of retail and professional services including banks, professional offices, restaurants, motor vehicle repair facilities, gasoline stations; use of sites for multiple uses is encouraged; conservation activities; elderly housing, multiunit; eldercare facility; nursing home; home occupation (first class); accessory structure; accessory apartment; child care home for not more than six children; child care home for more than six children; adult day care facility; art center; child care center or nursery; nursery or pre-school; community center; educational facility; government facility; library; museum; personal wireless service facility; reuse older single-family residence for a low impact nonresidential use; conference center; hotel; restaurant; restaurant, carry-out; convenience store with gasoline sales; craft shop with accessory production; gallery; retail store; retail store limited; financial institution; business services; funeral homes; medical clinic; personal services; office, business; office, professional; repair services; automotive service station; motor vehicles services facility; motor vehicle sales and service; automobile/car washing; manufacturing, light; caretaker apartment within a non-residential use; accessory building and structures; off street parking on the lot to serve the allowed use; structural parking, surface parking
Professional Office	Conversion of existing fraternities/sororities into office uses and multi-family housing; conservation activities; residence, single-family; elderly housing, multiunit; home occupation (first class); accessory structure; accessory apartment; accessory dwelling unit; child care home for not more than six children; child care home for more than six children; adult day care facility; child care center or nursery; nursery or pre-school; community center; educational facility; government facility; library; museum; religious use/facility; personal wireless service facility; reuse older single-family residence for a low impact nonresidential use; conference center; hotel; financial institution; business services; funeral homes; medical clinic; cinema; theater; office, business; office, professional; manufacturing, light; caretaker apartment within a non-residential use; accessory buildings and structures; off street parking on the lot to serve the allowed use; structural parking; surface parking
Multiunit Dwelling/Office Research	Multiunit housing while allowing the potential for office development; conservation activities; commercial agriculture; commercial animal husbandry; plant nursery; forestry; temporary sawmill; reuse of existing agricultural building; elderly housing, multiunit; eldercare facility; nursing home; home occupation (first class); home occupation (second class); accessory structure; accessory agricultural activities; accessory animal husbandry – poultry; accessory apartment; accessory dwelling unit; child care home for not more than six children; child care home for more than six children; adult day care facility; government facility; recreational facility, indoor; recreational playing fields; outdoor public utility facility; personal wireless service facility in accordance; reuse older single-family residence for a low impact nonresidential use; business services; medical clinic; office, business; office, professional; research facilities and labs; manufacturing, light; accessory buildings and structures; off street parking on the lot to serve the allowed use; structural parking; surface parking
Business Park	Office and research uses; conservation activities; forestry; temporary sawmill; reuse of existing agricultural building; eldercare facility; accessory structure; government facility; recreational facility, indoor; public utility facility; personal wireless service facility; business services; medical clinic; office, business; office, professional; marina sales and service; boatyard/boat club; research facilities and labs; manufacturing, light; accessory buildings and structures; off street parking on the lot to serve the allowed use; structural parking; surface parking
Office & Research – Rte 108	Office and research uses; conservation activities; commercial agriculture; commercial animal husbandry; plant nursery; forestry; temporary sawmill; reuse of existing agricultural

Zoning District	Permitted Uses
	building; eldercare facility; nursing home; home occupation (first class); home occupation (second class); accessory structure; accessory agricultural activities; accessory animal husbandry – poultry; accessory apartment; accessory dwelling unit; child care home for not more than six children; child care home for more than six children; adult day care facility; child care center or nursery; government facility; library; recreational facility, indoor; recreational playing fields, outdoor; public utility facility; personal wireless service facility; reuse older single-family residence for a low impact nonresidential use; business services; medical clinic; office, business; office, professional; research facilities and labs; manufacturing, light; accessory buildings and structures; off street parking on the lot to serve that allowed use; structural parking surface parking
Office & Research – Light Industry	Range of businesses that create employment; conservation activities; commercial animal husbandry; plant nursery; forestry; temporary sawmill; reuse of existing agricultural building; eldercare facility; nursing home; accessory structure; accessory agricultural activities; accessory animal husbandry – poultry; accessory apartment; accessory dwelling unit; child care home for not more than six children; child care home for more than six children; adult day care facility; government facility; recreational facility, indoor; recreational playing fields; outdoor public utility facility; personal wireless service facility in accordance; business; office, professional; research facilities and labs; manufacturing, light; accessory buildings and structures; off street parking on the lot to serve the allowed use; structural parking; surface parking
Lee	
Residential	Residential; agricultural; municipal buildings and structures; churches; accessory uses and special exception uses; recreational playing fields, outdoor
Commercial	Any industrial or commercial use on a site approved by the Planning Board; commercial excavation in accordance with the Excavation Permit issued by the Planning Board.
Madbury	
Residential-Agricultural	Dwellings; farms; single-family or two-family dwelling; general farming, including horticulture, floriculture, dairying, livestock and poultry raising, and other agricultural uses, or the raising of animals; home produce and home products and agricultural products may be bought and sold and exposed for sale in this district; tourist homes may be maintained and operated in this district; nursing homes, assisted living facilities and hospice facilities are permitted if they have frontage on and are accessed by State Routes 108, 155 or 9; building, structures, and uses, which are accessory to buildings or uses permitted by this ordinance; accessory apartments
Commercial & Light Industrial	Select industrial uses; commercial enterprises
Civic (assembly/office)	Churches, schools, municipal buildings, cemeteries, memorial parks, and public playgrounds

*Conditional uses and conditional uses that are allowed only as an adaptive reuse of an existing building are not included in this table.

[Source: Barrington, Durham, Lee, and Madbury Zoning Ordinances]

Prohibited Uses and Activities

A number of uses and activities are commonly prohibited in sensitive areas such as aquifer and wellhead protection zones and riparian and wetland buffers due to the potentially high risk they post for natural resources and/or human health. The following table contains uses and activities that are specifically prohibited in specific districts (or all districts) in the corridor communities.

Table 41. Prohibited uses for zoning districts in the watershed by community

Zoning District	Prohibited Uses
Barrington	
All districts	The storage, reprocessing, recycling, treatment or disposal of chemicals, hazardous substances, wastes or materials, municipal or industrial or medical waste, or metals, or the slaughtering and processing of animals and animal byproducts, as a principal or significant accessory use
Wetlands Protection District Overlay	All uses and structures prohibited except forestry/tree farming; agriculture; drainage ways; open space, wildlife refuges, conservation areas, nature trails and passive recreational uses; culverts, footbridges, catwalk and wharves
Durham	
All districts	All-terrain vehicles/off highway recreational vehicle facility; airport, private; airport, commercial; heliport; drive-through facilities other than as an accessory to a financial institution; junkyard; cemetery; warehouse, mini-storage
Shoreland Protection Overlay District	Any land use that poses a particular threat to the water quality of the adjacent shoreland or waterbody or downstream waterbodies including but not limited to: the establishment or expansion of salt storage yards; automotive junk or salvage yards; the storage or handling of hazardous wastes; the bulk storage of chemicals, petroleum products, or hazardous materials; use of any fertilizer, pesticide, or herbicide except in conjunction with accessory or commercial agriculture as provided for in 175-75.1. B.; the processing of excavated materials; the dumping of snow or ice removed from roads or parking lots; the disposal, handling, or processing of solid wastes including transfer stations, recycling facilities, and composting facilities; animal feedlots; the disposal of septage or other liquid or leachate wastes except for an approved septic system; construction on upland slopes which exceed 15%; dumping, spreading or any other application or use of treated soils or sludge from a sewage treatment plant.
Aquifer Protection Overlay District	Disposal of all solid waste either by stockpiling, landfilling or through injection wells that disposes waste into the ground; all on-site handling, disposal, storage, processing or recycling of toxic or hazardous materials; disposal of liquid or leachable wastes from all residential, commercial or industrial systems; subsurface storage of petroleum and other refined petroleum products; all industrial uses; storage of road salt and other deicing chemicals; dumping of snow containing deicing chemicals brought from outside of the Aquifer Protection Overlay District; commercial animal feedlots where animals are kept; automotive service and repair shops, and junk- and salvage yards; mining of land, unless it is incidental to a permitted use; sand and gravel excavation and other mining that is permitted, provided that such excavation or mining is not carried out within eight (8) vertical feet of the seasonal high-water table and that periodic inspections are made by the planning staff or its agent to determine compliance; dumping, spreading or any other application or use of treated soils or sludge from a sewage treatment plant
Lee	
All districts	Depositing, storage, burial or disposal of waste matter; private and commercial airports and heliports
Aquifer Conservation District	Subsurface storage of petroleum of refined petroleum products; outdoor storage of road salts or de-icing chemicals; dumping of snow containing road salts or other de-icing chemicals brought from outside the district; septage disposal sites or waste lagoons; solid

Zoning District	Prohibited Uses
	waste disposal areas; storage, discharge or disposal of hazardous or toxic materials except as permitted for agricultural use; automotive service and repair shops; junk and salvage yards; earth removal where the excavation would substantially damage a known aquifer and/or the recharge area of an aquifer
Shoreland Conservation District	Roads, driveways, or parking areas; permanent or temporary dwellings or other structures with the exception of structures necessary for the housing of pumps; wastewater disposal systems; excavation or filling unless approached by the Planning Board; cutting/removing vegetation
Madbury	
All Districts	Storage of radioactive materials
Wet Areas Conservation Overlay District	Erection of any structure; installation of an on-site wastewater treatment system; alteration of the surface configuration of the land by the addition of fill or dredging except in accordance with best management practices for agricultural land drainage provided such use is permitted in the underlying Land Use District; application of fertilizers, pesticides, or herbicides except in conjunction with allowed ag activities
Aquifer and Wellhead Protection Overlay District	Disposal or storage of solid waste, hazardous material or junk yard material that contains leachable toxic substances, except for temporary storage awaiting removal, provided that it is stored in a manner that avoids leaching and runoff; handling, disposal, storage or recycling of solid or liquid waste or hazardous or toxic material, except normal sanitary waste disposal from a state-approved domestic septic system installed by permit in accordance with NH RSA 485-A:13; application of wastewater residuals (sewage sludge) subject to regulation under NH DES Rules Env-800-811; junkyards; motor vehicle service or repair shops, except as a customary accessory use designed to provide routine service to the vehicles operated by the principal user; storage of road salt and other de-icers for use on-site, except in a shelter constructed to avoid leaching and runoff; the dumping of snow containing road salt or other de-icers brought in from outside the Aquifer and Wellhead Protection Overlay District; industrial uses that discharge contaminated wastewater on-site; animal feedlots; commercial storage of manure, fertilizers, herbicides, or other leachables, except for the temporary storage of such material when it is incidental to the principal use and stored in a manner that avoids leaching and runoff; the use of wood piling treated with creosote or other brush-applied preservative.
Shoreland Protection Overlay District	The erection of any structure (except those explicitly permitted in this Section); installation of an on-site wastewater treatment system; alteration of the surface configuration of the land by the addition of fill or dredging except consistent with best management practices for agricultural and forestry land drainage
Flood Hazard Overlay District	New habitable buildings or other structures (except as allowed below by Special Exception); processing or storage of excavation materials; storage of construction or other materials which would impede flow of floodwaters; filling; grading that results in obstruction of flood flows or reduces flood **storage** capacity; dumping; wastewater or septage treatment facilities; storage of floatable, or toxic, hazardous, or regulated substances. (Quantities typical for household use are permissible if stored 1 to 3 feet or more above base flood elevation.); unsecured tanks; junkyards; landfills; subdivision of land that would create a parcel that had no developable land outside the Flood Hazard area.

[Source: Barrington, Durham, Lee, and Madbury Zoning Ordinances]

State and Local Setback and Buffer Requirements

State Regulations

The Shoreland Water Quality Protection Act (SWQPA) (originally named the Comprehensive Shoreland Protection Act) establishes minimum standards for the subdivision, use, and development of shorelands adjacent to the state's public water bodies. SWQPA requires a shoreland impact permit for most new construction and filling activities within the Protected Shoreland. The Protected Shoreland includes the area within 250 feet from the reference line, which is the point from where all setbacks are determined. The reference line for rivers is the ordinary high water mark.

Shoreland Water Quality Protection Act requirements
Within 250 feet from the reference line:

- Lots with greater than 30% impervious surface require a stormwater management system, and if any waterfront buffer grid segment does not meet the minimum required 50 point tree and sapling score, addition vegetation must be planted.
- Projects that propose to exceed 20% impervious area of the lot must implement a stormwater management plan.
- Establishment/expansion of salt storage yards, auto junk yards, solid waste and hazardous waste facilities are not permitted.
- New septic systems require setbacks ranging from 75 to 125 feet depending on the soil characteristics
- A Site Assessment Study is required for all properties with on-site septic that are contiguous to or within 200 feet when selling developed waterfront property.
- An Alteration of Terrain Permit is required for any project that proposed to disturb more than 50,000 sq ft of contiguous terrain if any portion of the project is within the protected shoreland or disturbs an area having a grade of 25% of greater within 50 feet of any surface water.

Within 50 to 150 feet from the reference line:

- At least 25% of the area between 50 feet and 150 feet from the reference line must be maintained in an unaltered state.

Within 50 from the Reference Line:

- Primary structures must be set back at least 50 feet from the reference line.
- A vegetative buffer must be maintained.
- No ground cover shall be removed with the exception of a footpath.
- Groundcover must remain intact.
- Pesticide and herbicide applications can be applied by a licensed applicator only.
- Only low phosphorus, slow release nitrogen fertilizer can be applied beyond 25 feet of the reference line.[49]

Projects that are located on a Designated River have additional requirements to notify the specific river's Local Advisory Committee (LAC) by sending them a copy of the project application package by certified mail. The following permit applications must be supplied to the LAC:

- Wetland Permit Application
- Shoreland Permit Application
- Alteration of Terrain Permit Application

[49] NH DES. RSA 483-B Shoreland Water Quality Protection Act (SWQPA). *A Summary of Standards.*

Local Regulations

Local building setback requirements for the four communities within the Oyster River corridor exceed the state building setback standard of 50 feet. Septic setback standards are also equal or greater than the state setback requirement. Durham, Lee, and Madbury have stronger impervious surface limits than the state limit of 30%. State requirements under the Shoreland Water Quality Protection Act are summarized in the table below. The following tables display state and local setback and buffer requirements for the Oyster River, tributaries, wetlands, and vernal pools for each of the four river corridor communities

Table 42: State requirements for setback and buffers from the Oyster River

Resource	Requirement	SWQPA
Oyster River	Building Setback	50ft
	Septic Setback	75ft-125ft, depending on soil
	River Buffer	50ft
	Impervious Surface Limits (% Lot Coverage)	30%

[Source: Shoreland Water Quality Protection Act. Chapter 483-B]

Table 43: Local requirements for setbacks and buffers from the Oyster River as of 2010.

Requirement	Barrington	Durham	Lee	Madbury
Oyster River				
Building Setback	75ft	125ft	100ft	75ft
Septic Setback	75ft	125ft	125ft	100ft
Wetland Setback/Buffer	Septic – 50ft Building – 50ft	Septic – 125ft Building - 75ft Fertilizer - 75ft	Septic – 125ft Building -75ft	Septic – 75ft Building – 75ft Fertilizer – 25ft
Impervious Surface Limits (% Lot Coverage)	ND	No more than 20% impervious surface area in Aquifer Protection Area	Not to exceed 10% of impervious surface area in Aquifer Protection Area	Not to exceed 20% of impervious surface area in Aquifer Protection Area*
Natural Vegetative Buffer	-	-	-	50ft
Solid Waste Facility	-	-	-	50ft
Fertilizer Application Setback	-	75	-	25
No Vegetation Disturbance Buffer on Tidal Wetlands	-	25	-	50
No Disturbance and/or Managed Buffer Width for Different-Sized Waterbodies (ft)				
1st Order	-	75	-	25
2nd Order	75	100	100	25
3rd Order	75	100	100	25
4th Order +	100	100	100	25
Tributary Streams	Perennial stream – 75ft	Tidal sections – 250ft Perennial brooks – 75ft College Brook and Pettee Brook – 25ft	100ft	75ft

Requirement	Barrington	Durham	Lee	Madbury
		Septic - 125		
Wetland	50ft	Tidal - 100ft Non-tidal R & RC zones – 100ft Non-tidal other zones – 75ft	Structure – 75ft Septic – 125ft	Tidal and non-tidal areas – 75ft Very poorly drained soils – 75ft Poorly drained soils – 50ft
Vernal Pool	50ft minimum	100ft	Structure – 75ft Septic – 125ft	75ft
Prime Wetlands	100ft	150ft	Structure – 75ft Septic – 125ft	75ft

[Source: Local zoning ordinances; PREP Environmental Planning Assessment. 2010]
*2014 update: Impervious surface coverage limits include 25% in the General Residential and Agricultural District. Areas with over 15% or 2,500 square feet impervious cover in the Aquifer and Wellhead Protection Overlay District require a stormwater management plan.

Definition of a Structure

Barrington
Anything constructed, installed, placed or erected, whether above or below grade. For the purposes of floodplain management, a structure is a walled and roofed building, including a gas or liquid storage tank that is principally above ground, as well as a manufactured home.

Durham
That which is built or constructed with a fixed location on the ground or attached to something having a fixed location on the ground. "Structures" include but are not limited to a building, swimming pool, mobile home, billboard, pier, wharf, septic system, parking space/parking lot and deck. It shall not include a minor installation such as a fence under six (6) feet high, a mailbox, a flagpole, or an accessory shed. For the purposes of floodplain management, a structure is a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.

Lee
Anything built for the support, shelter, or enclosure of persons, animals, goods, or property of any kind, as well as anything constructed or erected with a fixed location on or in the ground, exclusive of fences and boundary walls, but shall include but not be limited to parking areas, driveways, roads, and leach fields.

Table 44: Requirements within the setbacks and/or buffers to the Oyster River

Zoning District/Overlay Zone	Conditional Uses/Exemptions
Barrington	
Wetland Protection District Overlay -Prime wetlands : 100ft or more required -Any wetland, vernal pool may require a greater buffer: 50ft	*Exemptions:* • On all lots created after March 11, 1997 and before March 13, 2001, no structure shall be built or located closer than thirty-five (35) feet to a wetland area. • An existing building within a buffer area may be repaired and/or replaced provided that the new or repaired structure, including any impermeable surfaces, shall not extend further into the buffer area than the footprint of the original foundation. • Wetland crossings that would fall under the New Hampshire Department of Environmental Services Administrative Rule – 303.04, as amended, that expedites certain types of wetland

Zoning District/Overlay Zone	Conditional Uses/Exemptions
	crossings may be permitted. • Wells / Well Lines • This ordinance shall not prohibit the construction of principal and accessory structures within the buffer zone or unimproved lots that were approved for subdivision by the Planning Board or which otherwise legally existed on or before March 13, 2001.
Shoreland Protection District Overlay • No structure of any type including, by way of example and not by way of limitation, all buildings, garages, sheds, parking lots and driveways, may be constructed within seventy-five (75) feet of the shoreline of any year-round stream, or any lake or pond over two (2) acres.	*Exemptions:* • Lots of record that existed prior to July 28, 1988 (which was the effective date of the original version of this provision) are exempt from these shoreland setback provisions to the extent that it can be demonstrated that conformance is impossible; • Installation of docks, floats and other structures that are customarily associated with the recreational use of water.
Groundwater Protection District Overlay • Regulated substances in outdoor storage areas must be protected from exposure to precipitation by some means of coverage, for example a roof. The storage must be located at least 50 feet from surface or storm drains, and outside the radius of any wells.	
Durham	
Shoreland Protection Overlay District • Applies to all land within 250ft of the reference line of Great and Little Bay, the Oyster River, the Lamprey River, Durham Reservoir, Moat Island Pond, Johnson and Bunker Creeks, and Follett's Brook including the tidal sections of their tributary streams and land within 75ft of all other perennial brooks. • Building and structures setback: • Great and Little Bay, the Oyster River, the Lamprey River, Durham Reservoir, Moat Island Pond, Johnson and Bunker Creeks, and Follett's Brook including the tidal sections of their tributary streams: 125ft • All other perennial brooks except College Brook and Pettee Brook: 75ft • College Brook and Pettee Brook: 25ft Septic setbacks: • Great and Little Bay, the Oyster River, the Lamprey River, Durham Reservoir, Moat Island Pond, Johnson and Bunker Creeks, and Follett's Brook including the tidal sections of their tributary streams: 125ft • All other perennial brooks: 75ft	*Conditional Uses:* • The construction of streets, roads, access ways, bridge crossings, and utilities including pipelines, power lines, and transmission lines • Commercial agriculture and plant nurseries subject to the performance standards of 175-75.1. A and B • The construction or expansion of a non-residential or multi-unit building or structure • Accessory buildings and structures other than those allowed as permitted uses • Outdoor recreational facilities that do not require the construction of buildings or other structures
Wetland Conservation Overlay District • Width of the upland buffer strip from the reference line of the wetland shall vary with the type of wetland:	*Conditional Uses:* • The construction of streets, roads, access ways, bridge crossings, and utilities including pipelines, power lines, and transmission lines;

Zoning District/Overlay Zone	Conditional Uses/Exemptions
• Bogs, prime wetlands, and rare and exemplary wetland communities: 150ft • All other tidal wetlands: 100ft • Vernal pools: 100ft • All other non-tidal wetlands: • In the R and RC zones: 100ft • In all other zones: 75ft	• Commercial agriculture and plant nurseries within the upland buffer strip subject to the performance standards of 175-65.C • The construction of a non-residential building within the upland buffer strip in a commercial or office-residential zoning district • Accessory structures and buildings other than those allowed as permitted uses • Outdoor recreational facilities that do not require the construction of buildings or structure
Lee	
Shoreland Conservation District • All land located within 100ft of the shores of the Lamprey River, Little River, North River, Oyster River, Dube Brook, Chesley Brook and Wheelwright Pond	
Wet Soils Conservation District • Includes soils classified as poorly or very poorly drained as well as areas such as swamps, marshes, and bogs that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation for life in saturated soil conditions Special Provisions: • No septic tank or leach field may be constructed or enlarged closer than 125ft to any wetland • No structure with the exception of wells and wellhousing shall be constructed within 75ft of the Wet Soils zone	*Exceptions:* • Streets, roads, and other access ways and utility right-of-way easements, including power lines and pipe lines, if essential to the productive use of land not so zoned and if so located and constructed as to minimize any detrimental impact of such uses upon the Wet Soils; water impoundment; fire ponds; the undertaking of a use not otherwise permitted in the zone if it conflict with purpose and intent of the zone
Madbury	

Wet Area Conservation Overlay District
• Includes all area identified as a wetland, as defined by the State, poorly drained and very poorly drained soils, and vernal pools
• Protected by adjacent undisturbed, naturally vegetated, contiguous upland buffers of at least 25ft from the reference line or delineation of the wet area
• Building setback:
  • Bogs, prime wet areas and rare and exemplary wet area communities: 75feet
  • All other tidal wet areas: 75ft
  • Vernal pools: 75ft
  • All other non-tidal wet areas: 75ft
  • Very poorly drained soils: 75ft
  • Poorly drained soils: 50ft
	Conditional Uses:
	• Uses otherwise prohibited (e.g., driveway access or wetland crossing) only if they are found to be consistent with this ordinance, and do not have an adverse impact on the wet area as determined by a wetland scientist and concurred with by the Planning Board.
	• Any use that involves a change to a wet area that requires a state dredge and fill application in accordance with (RSA 483-A).

Aquifer and Wellhead Protection Overlay District • Includes all lands above stratified drift aquifers and lands designated by the State as public water supply wellhead protection	*Allowed uses subject to limitations:* Forestry and agriculture, provided that fertilizers, herbicides, manure and other leachables are not used or stored within said district unless such use conforms to State Department of

Zoning District/Overlay Zone	Conditional Uses/Exemptions
lands • Area within 400ft of an identified public water supply wellhead	Environmental Services best management practices. *Conditional Uses:* • General service and repair shops, including but not limited to: furniture stripping, painting, and refinishing; photographic processing; printing; appliance and small engine repair; boat repair, service and refinishing; refrigeration, heating, ventilating and air conditioning shops • Metalworking shops, including, but not limited to: machine shops; metal plating shops • Heat treating shops; smelting shops; and jewelry making shops • Manufacturing facilities, including but not limited to: electronics and chemical manufacturing, processing, and reclamation; paper, leather, plastic, fiberglass, rubber, silicon and glass making; pharmaceutical production; pesticide manufacturing; and chemical preservation of wood and wood products • Laboratories and professional medical offices, including but not limited to: medical, dental, and veterinary offices; and research and analytical laboratories • Cleaning services, including but not limited to: dry cleaner; laundromats; beauty salons; and car washes • Storage of petroleum or related products other than up to 550 gallons of heating oil for on-premises use.
Shoreland Protection Overlay District • Includes all areas of land within: • 300ft horizontal distance of the seasonal high water level of the Bellamy Reservoir • 100ft horizontal distance of the seasonal high water level of the Bellamy and Oyster Rivers, • 75ft horizontal distance of the seasonal high water level of all other brooks, streams, ponds and public water supplies within the Town, • Areas of land within 150ft horizontal distance of the shoreline of Little Bay Estuary • Area of land within 150ft horizontal distance of the upland extent of any tidal wetlands adjacent to the Little Bay Estuary	*Allowed uses subject to limitations:* • The construction of fences, footbridges, catwalks, and wharves only, provided: • Said structures are constructed on untreated posts or pilings in order to permit the unobstructed flow of water • Structures do not obstruct navigation on tidal creeks • The natural contour of the shoreline is preserved; and, • The Building Inspector has reviewed and approved the proposed construction • Forestry and tree farming to include the construction of access roads for this purpose. Within this District the cutting of trees shall be limited to fifty percent (50%) of the basal area of all live trees two (2) inches in diameter (as measured four and one-half feet above the ground) and over, in a 20-year period. The remaining uncut trees shall be left well distributed throughout the area that was cut. *Conditional Uses:* Construction of roads and other access ways, underground pipelines, powerlines, and other transmission subject to these conditions: • The proposed construction is essential to the productive use of land that is not within the Shoreland Protection district • The proposed construction does not cross-tidal tributaries surrounded by very poorly drained soils. • Within the Shoreland Protection District boundaries, no two crossings of any one brook or stream occur within 1,000 feet

Zoning District/Overlay Zone	Conditional Uses/Exemptions
	horizontally of each other. • Design and construction methods will minimize detrimental impact upon the Shoreland. • The proposed construction methods for powerlines, pipelines or other transmission lines includes provisions for restoration of the site as nearly as possible to its original grade and condition. • No alternative route that does not cross the shoreland or has less detrimental impact on the shoreland is feasible. • Economic advantage alone is not reason for the proposed construction. • Uses otherwise prohibited (e.g., driveway access or wetland crossing) only if they are found to be consistent with this ordinance, and do not have an adverse impact on the wet area as determined by Wetland Scientist and concurred with by the Planning Board.
Flood Hazard Overlay District • Applies to lands designated as special flood hazard areas by the FEMA Flood Insurance Study for Strafford County, NH • Requires permits for all proposed development	*Conditional Uses:* • Water impoundments for the purpose of creating a water body for wildlife, fire safety, on-site detention of stormwater runoff and/or recreational uses • Water-dependent uses, such as docks, boathouses, and water powered projects *Additional Conditional Uses if not in Floodway:* • Addition to existing structures, including manufactured homes, and replacement of manufactured homes • Accessory structures to existing primary uses when it is not practicable to construct the accessory structure on a portion of the lot outside of the Flood Hazard Area Overlay District • One principle building on a preexisting lot of record with no developable land outside Flood Hazard Area Overlay District • New or expanded septic systems if no suitable location exists for the system on a portion of the lot outside of the Flood Hazard Area Overlay District • Construction, repair or maintenance of streets, roads, and other access ways, including driveways, footpaths and bridges, and utility right-of-way easements, including power lines and pipe lines, wastewater collection facilities and pump stations • Undertaking of a use not otherwise permitted in the district if it can be shown that such proposed use does not involve the erection of structures or filling and is in accordance with all the purposes of the district

[Source: Local Zoning Ordinances]

Development

Land Use and Population Trends

Land use decisions have a significant impact on the environmental and economic sustainability of communities. Balancing the protection of resources that enable a high quality of life within the region awhile also supporting economic development is key to long term sustainability. Due to the relatively undeveloped nature of the river corridor and its proximity to rapidly developing urban and suburban areas in within Strafford County - where population increased by approximately 10% between 2000 and 2010 – protection of the Oyster River watershed is a high priority.

Impervious Surface Cover

Impervious surface cover increased by 68% (1,755 acres) within the watershed and 60% (267 acres) within the river corridor between 1990 and 2010. The table below displays this change. Durham and northeast portion of the watershed in Dover have the greatest impervious surface cover (see Figure 18). This data does not include disturbed land such as highly compacted lawns, which can contribute nearly as much runoff as paved surfaces.[50]

There is a strong relationship between impervious cover and water quality.[51] Studies show that a watershed is likely to become impaired at 10% imperviousness, and this threshold is used by EPA as an indicator that water resources might be impacted. At this threshold, stream channels are likely to become unstable due to increased water volumes and stream bank erosion and water quality and stream biodiversity decrease. When impervious surface cover exceeds 25%, a watershed can become severely impaired, stream channel stability declines, and water quality and stream biodiversity are degraded.[52]

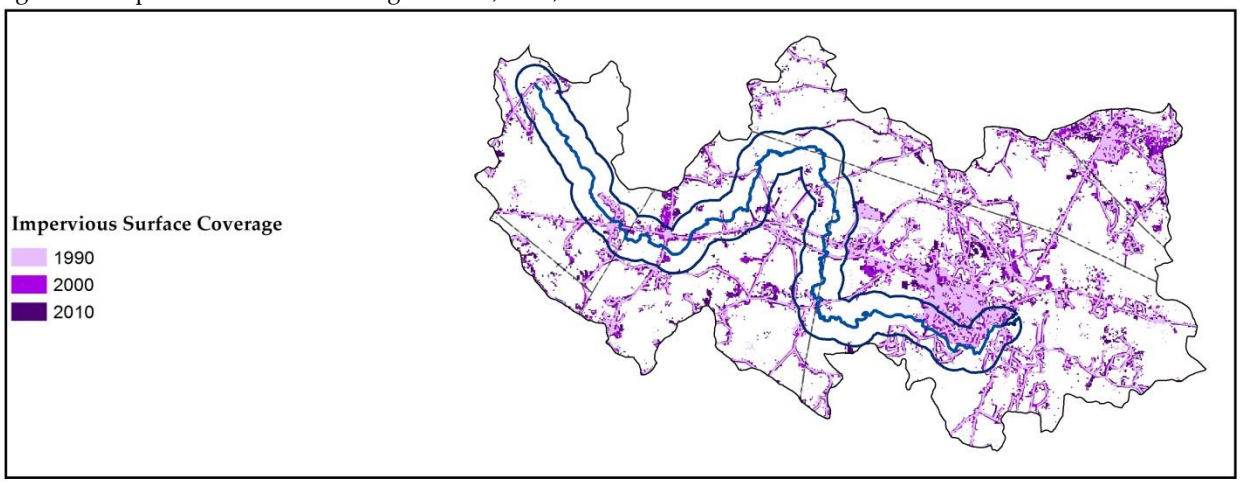
Table 45: Impervious surface coverage statistics for the Oyster River watershed and corridor from 1990 to 2010.

Impervious Surface	**1990**		**2000**		**2010**		**% change 1990-2000**
	acres	% of area	acres	% of area	acres	% of area	
Watershed	2570.5	12.9%	3510.4	17.7%	4325.1	21.8%	68.3%
Corridor	442.6	11.3%	587	15%	709.7	18.2%	60.3%

[Source: UNH GRANIT]

[50] Office of Sustainable Communities. "Protecting Water Resources with Higher-Density Development." US EPA. 2006.
[51] Ibid.
[52] Ibid.

Figure 18. Impervious surface coverage in 1990, 2000, and 2010.



[Source: UNH GRANIT]

Population Growth

Population within the six communities in the watershed increased by approximately 25% (12,751 people) between 1990 and 2010, with the greatest growth occurring in Nottingham and Barrington (Table 46). The total population within these communities is projected to increase by approximately 15%, or approximately 9,776 people, between 2010 and 2014.[53]

Table 46: Population statistics from 1990 to 2010

Population	% Community in Watershed	1990	2000	2010	% Change 1990-2010	2040 Projection
Barrington	9. 3%	6,156	7,475	8,576	39.3	9,970
Dover	5.8%	25,420	26,993	29,987	18.0	33,950
Durham	47.5%	11,816	12,664	14,638	23.9	17,134
Lee	36.8%	3,699	4,169	4,330	17.1	4,581
Madbury	42.6%	1,408	1,509	1,771	25.8	2,101
Nottingham	1.0%	2,837	3,733	4,785	68.7	6,127
Total		**51,336**	**56,543**	**64,087**	24.8	73,863

[Source: U.S. Census Bureau; NH OEP]

Riparian Buffer Conditions within the Corridor

Riparian areas and buffers are the vegetated upland adjacent to surface waters and wetlands that help reduce the adverse effects of human activities on these recourses. The primary function of a buffer is to physically protect and separate a wetland from future disturbance.

Riparian areas and buffers provide valuable functions and services including:

- Absorbing and filtering runoff to protect water quality
- Intercepting and slowing runoff to prevent erosion
- Providing habitat for wetland species and upland species
- Improving landscape aesthetics
- Maintaining recreational uses

[53] NH Office of Energy and Planning. March 22, 2011

Chapter VI: Priority Management Issues, Goals, and Implementation Strategies

Priority Management Issues in the River Corridor and Watershed

The following management issues and goals were identified by the ORLAC and SRPC during the development of the Oyster River Management Plan. This process included referencing other relevant river corridor plans and reaching out to local and state agencies.

I. Water quality and Quantity Protection

Protect and Restore Riparian Buffers
Raise Awareness of Non-Point Source Pollution
Limit Water Runoff and Nutrient Transport
Maintain a Library/Reference List of Ongoing and Completed Studies of the Watershed/Region
Establish Instream Flow Rules
Protect Current and Future Drinking Water Sources
Monitor and Identify Hazards

II. Flood Management and Remediation

Flood Management
Maintain Stream Road Crossings
Identify and Maintain Major Flood Storage Areas
Inventory and Maintain a Record of Impervious Surfaces
Maintain River Buffer and Proper Channels
Reduce Man-Made Runoff

III. Land Protection, Resource, and Habitat Conservation

Habitat Conservation
Identify and protect Wildlife and Aquatic Habitat

IV. River Corridor and Watershed Planning

Collaboration and Engagement
Enhance and Provide Technical Assistance
Inventory Current Development Regulations
Inventory and Protect Cultural Resources
Inventory and Promote Recreational Resources
Catalog Existing Data and Resources and Identify Data Needs
Protection of Great Bay/Piscataqua Region
Raise Awareness of the River Management Plan

V. Stewardship, Education, and Outreach

Raise Awareness of Stewardship Activities
Enhance Website
Outreach Via Pamphlets
Communicate Watershed Activity to NHDES
Promote Regulatory Consistency and Enforcement
Promote Non-Regulatory Solutions
Educate about Costs and Cumulative Impacts and Threats to the River

Evaluating Progress

To measure success and evaluate whether steps are being taken to reach desired managements priorities and goals, an annual audit of strategy actions taken by ORLAC and/or the lead contact, organization, and partners assigned to complete a strategy or action item is suggested. The person(s), organizations and partnerships that will be responsible for implementing each strategy should establish benchmarks for implementing each strategy based on dedicated resources, funding availability, , availability of volunteers, and other commitment from partnerships.

Funding Needs

Funding is available annually from a variety of local, state, federal, and nonprofit sources. It is recommended that ORLAC develop a database of these funding sources. A work plan with a budget should be developed for each Implementation Action.

Goals and Implementation Strategies

Based on the management issues, the following goals and implementation strategies have been developed by ORLAC and SRPC. Strategies are specific tasks, products, or actions that can be implemented in order to meet the specific objective. Potential partners are identified for each strategy (see Table. 47). These organizations and groups are likely to be involved in implementing a specific strategy. Table 47 also identifies a recommended timeframe in which to initiate, continue, and/or complete the implementation strategy.

MANAGEMENT ISSUE #1: WATER QUALITY & QUANTITY PROTECTION

GOAL 1: PROTECT AND RESTORE RIPARIAN BUFFERS
STRATEGIES:

- Encourage permanent land protection of land abutting the river and its tributaries by identifying priority conservation areas, educating property owners about tools and incentives for conserving land and identifying sources of funding to purchase property or development rights.
- Encourage the development of overlay districts that limit the impact of development of land abutting the river and its tributaries through minimum open space requirements, cluster development, setbacks and buffers, and consideration of soil type and vegetative cover.
- Support state enforcement of the Shoreland Water Quality Protection Act and adoption of stringent local buffer and setback requirements for development in the river corridor.
- Identify watershed-wide goals for fertilizer setback application.
- Include local land use boards, elected officials, municipal staff, and developers in education, outreach, and publicity initiatives related to buffers and buffer protection.
- Facilitate a forum with local land use boards and developers within the region to identify potential opportunities to streamline and simplify development process to ensure environmental protection and minimize the number of exceptions granted while allowing for economic growth.

GOAL 2: RAISE AWARENESS OF NON-POINT SOURCE POLLUTION
STRATEGIES:

- Support the development of ordinances that limit the use of fertilizers that contain nitrogen and/or phosphorus in the watershed.

- Provide information to local land use boards and property owners about how non-point source pollution can impact water quality and habitat utilizing existing guidance and brochures. Develop additional, updated material as necessary.
- Identify opportunities to engage public in ongoing water quality monitoring efforts.
- Encourage local adoption of the 100 foot suggested protective standard for fertilizer and septic systems.
- Review the stormwater ordinances and site plan and subdivision regulations of communities within the watershed and encourage consistency and adherence to regulations during site plan review and approval process.
- Create and annually update an information sheet on new best management practices for reduction of nitrates and salt to conservation commissions and local land use boards.
- Develop an educational brochure or factsheet that summarizes the findings and recommendations of Oyster River Integrated Watershed Plan for Nitrogen Load Reductions
- Conduct public outreach on the impact of lawn care fertilizers, leaking septic systems, and stormwater treatment.
- Collaborate with UNH to identify strategies to reduce non-point source pollution from agriculture.

GOAL 3: LIMIT WATER RUNOFF AND NUTRIENT TRANSPORT
STRATEGIES:

- Coordinate with local conservation commissions to review development plans for adherence to regulations including stormwater and erosion and sediment regulations, setback and buffer requirements, and open space minimum requirements.
- Identify potential threats to the Oyster River associated with development that are unregulated.
- Develop and maintain an inventory of developable land within the river corridor. Collaborate with partners to prepare maps of conservation land, developed land, and developable land.
- Encourage routine, scheduled, and directed maintenance efforts of low impact development projects.
- Support a multi-faceted approach to reducing nitrogen that includes controls at wastewater treatment facilities, identification of failing pipes, septic systems, etc., development of ordinances that regulate the spreading of sludge on agricultural fields, and source control through stormwater management.
- Enhance restoration sites on College Brook and Pettee Brook to ensure that runoff and stormwater are addressed. Ensure that future restoration projects address runoff and stormwater.

GOAL 4: MAINTAIN A LIBRARY/REFERENCE LIST OF ONGOING AND COMPLETED STUDIES OF THE WATERSHED/REGION
STRATEGIES:

- Conduct a literature review to identify studies of water quality that have been completed within the watershed by non-profits, state agencies, UNH, consulting firms, municipal public works, etc.
- Reach out to state and local partners to identify ongoing projects and data collection within the watershed and region.
- Identify funds and/or volunteers or students to develop and maintain a well-organized and user-friendly virtual library.
- Publicize library resources and website through list serves, municipal websites, news articles, etc.

GOAL 5: ESTABLISH INSTREAM FLOW RULES
STRATEGIES:

- Educate officials and the public about the significance of instream flow rules to protect the Oyster River flow from human activities that can have a significant impact on river dynamics.
- Support the establishment of instream protected flows following the review of the instream flow pilot projects in 2015.

GOAL 6: PROTECT CURRENT AND FUTURE DRINKING WATER SOURCES
STRATEGIES:

- Identify potential sources of drinking water sources such as the Spruce Hole Aquifer and ensure that water resource protection efforts adequately protect these sources.

- Support the protection of current and future drinking water sources by developing a detailed map of protected areas within the watershed and identifying gaps in surface and groundwater protection.
- Support sustainability and conservation efforts by promoting best management practices for conservation and distributing existing outreach and educational material
- Support remediation of the Tibbett's Road Superfund Site by identifying brownfield remediation funding.
- Support groundwater reclassification to provide local entity with the authority to enforce best management practice rules in the protected area.

GOAL 7: MONITOR AND IDENTIFY HAZARDS
STRATEGIES:

- Support current monitoring efforts by coordinating with partners to train and recruit volunteers, identifying funding for sampling equipment, and developing outreach materials. Develop technical tools to guide water quality monitoring in the Oyster River watershed.
- Obtain and analyze data from monitoring efforts within the watershed including USGS stream gage data, VRAP water quality data, PREP monthly sampling data, and data from relevant studies.
- Collaborate with partners to identify additional sampling sites, data needs, and long term monitoring needs within the watershed.
- Identify sensitive areas that require targeted monitoring due to their vulnerability to current and potential hazards including nitrogen, phosphorus, road salt, stormwater, and impervious surface.
- Develop a strategy for monitoring how changes in precipitation and temperature impact water quality, water quantity, habitat, and species composition.
- Identify former industrial sites and review historical records of tanneries for potential sources of toxic chemicals.
- Establish pollution reduction goals for Wendy's Brook.

MANAGEMENT ISSUE #2: FLOOD MANAGEMENT AND REMEDIATION

GOAL 1: FLOOD MANAGEMENT
STRATEGIES:

- Encourage mapping and prioritization of important flood storage areas abutting the river and its tributaries.
- Encourage permanent protection of flood storage areas abutting the river and its tributaries through land use protection tools such as conservation easements.
- Continue collection of stream assessment data including erosion and sedimentation, vegetation loss, bank stability, and habitat loss, as part of the VRAP program. Provide an annual summary or report to watershed communities.
- Review local hazard mitigation plans to identify flood hazard areas.
- Conduct stream geomorphic assessment to identify Fluvial Erosion Hazard areas. Develop a fluvial erosion hazard overlay.
- Recommend that communities adopt site plan, subdivision, and zoning ordinance regulations for stormwater. Refer to the Southeast Watershed Alliance's Model Stormwater Standards for Coastal Watershed Communities.
- Support modification of building standards based on revised FEMA flood maps in 2015.

GOAL 2: MAINTAIN STREAM ROAD CROSSINGS
STRATEGIES:

- Refer to the Oyster River Culvert Analysis for detailed information about how the hydrology and drainage system of the watershed are vulnerable to climate change. Communicate impacts to the existing culvert infrastructure to municipal officials and encourage proper sizing of culverts.
- Develop recommendations for best management practices for road crossings and a priority list of improvements for road crossings within the river corridor and watershed to support allocation of municipal funds in Capital Improvement Plans and annual budgets.
- Engage property owners in monitoring flood events and impacts. Document and report rain event flooding to local officials.

- Use existing data from NH DOT and Strafford Regional Planning Commission to conduct corridor site assessments to document stream crossing conditions, stream morphology, and aquatic habitat.
- Identify strategies to reduce flooding at the Route 4 crossing over the Oyster River and Caldwell Brook.
- Assist with the development and implementation of flood remediation at Cherry Land and Hayes Road crossings.

GOAL 3: IDENTIFY AND MAINTAIN MAJOR FLOOD STORAGE AREAS
STRATEGIES:

- Evaluate the adequacy and consistency of existing water storage protection measures across local zoning ordinances in the watershed.
- Review updated FEMA flood plain maps to identify additional storage areas.
- Identify and map areas where new flooding occurred during large storm events.
- Present information to elected officials about the importance of preserving flood storages areas to protect public and private property.
- Develop maps for watershed communities that display key wetland and uplands that provide storage.
- Conduct outreach to property owners within the watershed about the importance of preserving wetlands and uplands.
- Support local regulations such as open space or conservation subdivisions to preserve key wetlands and uplands within the river corridor and watershed.

GOAL 4: INVENTORY AND MAINTAIN A RECORD OF IMPERVIOUS SURFACES
STRATEGIES:

- Compile existing impervious surface data.
- Refine impervious surface cover maps as new data becomes available.
- Create a database to track impervious surface data associated with new development within the corridor

GOAL 5: MAINTAIN RIVER BUFFER AND PROPER CHANNELS
STRATEGIES:

- Promote buffer protection through ordinances that regulate development and encourage implementation of best management practices.
- Identify and map areas where erosion and sedimentation problems are present. Develop a list of prioritized projects to mitigate erosion and sedimentation.
- Promote proper culvert sizing, replacement, and appropriate design standards to accommodate future changes in precipitation using the Oyster River Culvert Analysis.

GOAL 6: REDUCE MAN-MADE RUNOFF
STRATEGIES:

- Support municipal adoption of site plan regulations that require adoption of Low Impact Development (LID) site planning and design strategies to the maximum extent possible for new development, as required in Durham.
- Collaborate with the UNH Stormwater Center and Cooperative Extension to provide outreach and education to homeowners about minimizing runoff through methods such as rain gardens, rain barrels, and reducing impervious surface.
- Encourage municipalities within the watershed to incorporate LID and best management practices for reducing runoff into Capital Improvement Plans. Identify funding sources for planning and installation of LID.
- Provide developers with information about the importance of minimizing impervious surface cover and implementation strategies to do so.
- Collaborate with UNH to identify appropriate stormwater runoff mitigation at the Lee Traffic Circle.

MANAGEMENT ISSUE #3: LAND PROTECTION, RESOURCE, AND HABITAT CONSERVATION

GOAL 1: HABITAT CONSERVATION
STRATEGIES:

- Encourage permanent land protection of land abutting the river and its tributaries through land protection mechanisms such as conservation easements.
- Collaborate with conservation commissions within watershed communities to identify priority parcels to conserve.
- Education property owners about incentives for conserving land.
- Identify opportunities to finance land acquisition.
- Encourage zoning ordinances and overlay districts that limit the impact development of land abutting the river and its tributaries.
- Organize and support education activities that raise awareness of habitat conservation and/or restoration. Develop educational material and identify community events to attend and distribute information.

GOAL 2: IDENTIFY AND PROTECT WILDLIFE AND AQUATIC HABITAT
STRATEGIES:

- Utilize existing technical studies including The Land Conservation Plan for New Hampshire's Coastal Watersheds and the New Hampshire Wildlife Action Plan and the map set for this plan to identify significant wildlife habitat.
- Identify key species' habitat requirements and threats to the integrity of these habitats such as sedimentation and erosion, nonpoint source pollution, and inadequate culvert size.
- Support the establishment of instream protected flows following the review of the instream flow pilot projects in 2015.
- Identify strategies to improve fish passage on Dube Brook. Seek funding and volunteer support for restoration.
- Investigate potential dredging needs in Mill Pond to address sedimentation.

MANAGEMENT ISSUE #4: RIVER CORRIDOR AND WATERSHED PLANNING

GOAL 1: COLLABORATION AND ENGAGEMENT
STRATEGIES:

- Develop a list of stateholders and partners.
- Establish a process for expanding dialogue about water resource protection and threats in watershed communities.
- Meet annually with local land use boards to discuss watershed-wide opportunities, challenges, and best practices to balance economic development and growth with water quality preservation.
- Partner with NHDES, UNH Stormwater Center, UNH Cooperative Extension, and others to coordinate and conduct trainings and provide information about a suite of watershed management issues including land and resource protection regulations, emerging science and technology, and best management practices and success stories.

GOAL 2: ENHANCE AND PROVIDE TECHNICAL ASSISTANCE
STRATEGIES:

- Identify resources to support ORWA member attendance at workshops and trainings.
- Refer to resources including NHDES's Innovative Land Use Planning Techniques: A Handbook for Sustainable Development, EPA's Handbook for Developing Watershed Plans to Restore and Protect Our Waters, and resources available at the Center for Watershed Protection website to identify strategies to encourage adoption of innovative land use controls.
- Meet with municipal staff and planning boards to discuss regional mapping needs. Collaborate with Strafford Regional Planning Commission to develop watershed maps.
- Support correction of Dube Brook Oyster River hydro-annotation.

GOAL 3: INVENTORY CURRENT DEVELOPMENT REGULATIONS
STRATEGIES:

- Refer to this plan and local planning and zoning documents to develop a summary of current development regulations, review regulations for consistency/variation by Town and State, and to identify gaps in regulations.
- Identify strategies to simplify and standardize development regulations within the corridor and/or watershed.
- Engage developers and local officials in a discussion of
- Communicate recommendations for development regulations local officials.

GOAL 4: INVENTORY AND PROTECT CULTURAL RESOURCES
STRATEGIES:

- Prioritize the protection of cultural resources identified in this plan.
- Survey community members to identify cultural resources they value.
- Develop a guide of cultural resources to distribute to watershed communities. Identify resources that are publically accessible. Identify resources that are vulnerable to development or changes in land use or river flow.
- Work with UNH to establish a database of scientific research projects that have occurred on the river or within the corridor.

GOAL 5: INVENTORY AND PROMOTE RECREATIONAL RESOURCES
STRATEGIES:

- Collaborate with conservation commissions to develop detailed maps of recreational resources within the corridor and watershed.
- Identify threats to recreational resources, including impacts to boating and recreational activities due to silting in the tidal portion of the Oyster River resulting from upstream activities.
- Develop a guide of recreational resources to distribute to watershed communities.

GOAL 6: CATALOG EXISTING DATA AND RESOURCES AND IDENTIFY DATA NEEDS
STRATEGIES:

- Continue to collect and compile data on river corridor and watershed conditions.
- Identify new sources of data and data needs.
- Ensure that data and information about the watershed and corridor are available on or through the ORWA website.
- Encourage watershed communities to complete National Resource Inventories and assist communities with applying for grants to fund these studies.

GOAL 7: PROTECTION OF GREAT BAY/PISCATAQUA REGION
STRATEGIES:

- Collaborate with other local watershed associations and organizations to identify common and unique river management issue.
- Collaborate with other local watershed groups to review consistency or local regulations, planning and management needs, and data needs across management within the Great Bay/Piscataqua River watershed.
- Identify threats to the Oyster River and watershed associated with land use, activity, or groundwater contamination outside the watershed.
- Identify habitat improvement or restoration needs within other watersheds that impact the quality of habitat in the corridor and watershed.

GOAL 8: RAISE AWARENESS OF THE RIVER MANAGEMENT PLAN
STRATEGIES:

- Encourage adoption of all or part of the River Management Plan as part of the Master Plans of each watershed community. Facilitate adoption by providing copies of this plan to Land Use Boards and elected officials and presenting threats and management needs and recommendations to Land Use Boards and elected officials.

- Identify a watershed coordinator to facilitate the development of a publicity plan to advertise the plan, to communicate the implementation of management issues, goals, and strategies in this plan, and to publicize success stories and achievements.
- Develop a database of diverse media outlets and list serves to publicize the plan and future events.
- Coordinate the release of the plan with a watershed wide gathering or stewardship event and present major goals, threats, and management and volunteer needs.

MANAGEMENT ISSUE #5: STEWARDSHIP, EDUCATION, AND OUTREACH

GOAL 1: RAISE AWARENESS OF STEWARDSHIP ACTIVITIES
STRATEGIES:

- Develop an outreach campaign to raise awareness of stewardship activities within the watershed.
- Identify and acquire funding to develop and implement education and outreach activities.
- Identify new groups and organizations to engage.
- Promote stewardship by river users and riparian property owners by establishing a sponsorship program for river and tributary segments to provide an opportunity for local volunteer and civic groups to participate in ongoing cleanup efforts.

GOAL 2: ENHANCE WEBSITE
STRATEGIES:

- Develop ORWA website to facilitate outreach and education, dissemination of information, and promote river related events and projects.
- Provide links to partners, relevant studies and data, and best management practices.
- Publicize maps on website.
- Solicit website development assistance from UNH students.

GOAL 3: OUTREACH VIA PAMPHLETS
STRATEGIES:

- Create and distribute pamphlets that highlight identified and prioritized concerns such as fertilizer use in the watershed to watershed communities.
- Establish clean, consistent messaging for communicating about threats to water quality and habitat.
- Seek funding sources for outreach activities.

GOAL 4: COMMUNICATE WATERSHED ACTIVITY TO NHDES
STRATEGIES:

- Continue to produce annual water quality monitoring reports.
- Comment on developments within the corridor or watershed and provide recommendations to NHDES.

GOAL 5: PROMOTE REGULATORY CONSISTENCY AND ENFORCEMENT
STRATEGIES:

- Review and compare consistency of zoning and overlay districts in watershed and corridor communities.
- Utilize existing studies, state recommended standards, and research of best management practices to evaluate the effectiveness of current zoning and overlay districts.
- Collaborate with conservation commissions to review and comment on proposed development that may negatively impact the river and corridor.
- Evaluate enforcement behavior and variance practice. Encourage planning boards to limit exemptions.
- Recommend watershed-wide minimum standards for protection of the watershed.

GOAL 6: PROMOTE NON-REGULATORY SOLUTIONS
STRATEGIES:

- Educate property owners and municipal officials about voluntary strategies to mitigate the impact of human activity on the river and river corridor.

- Increase public awareness of the importance of buffers by collaborating with UNH Cooperative Extension to present and distribute information about landscaping with native species and shade trees and providing riparian habitat.
- Identify accessible and highly visible locations for demonstration projects such as parks or schools that model best management practices for landscaping including buffers and rain gardens.
- Encourage municipal Department of Public Works participation in Green SnowPro training and certification to reduce salt application.

EDUCATE ABOUT COSTS AND CUMMULATIVE IMPACTS AND THREATS TO THE RIVER
STRATEGIES:

- Review local and national case studies of best practices for watershed management to identify examples of cost savings associated with protection of water quality and quantity.
- Work with public works departments to identify costs associated with treating drinking water.
- Conduct a literature review and compile information about ecosystem services and the monetary and nonmonetary benefits provided by the river and watershed to incorporate into educational and outreach material.
- Educate land use boards about the cumulative impact of development and human activities on the river and corridor.
- Develop and provide informational resources on current and future impacts of development to developers.

Table 47. Potential partners and timeframe for management issues, goals, and recommended implementation strategies.

Management Issues, Goals, Strategies	Potential Partners: Local and Regional Partners: ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Town: Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	State: NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	Federal: USGS	FEMA	GBNERR	NRCS	Timeframe: Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Management Issue 1: Water Quality & Quantity Protection																																									
Goal 1: Protect and Restore Riparian Buffers																																									
Encourage permanent land protection of land abutting the river and its tributaries by identifying priority conservation areas, educating property owners about tools and incentives for conserving land and identifying sources of funding to purchase property or development rights.								•																														—		
Encourage the development of overlay districts that limit the impact of development of land abutting the river and its tributaries through minimum open space requirements, cluster development, setbacks and buffers, and consideration of soil type and vegetative cover.															•		•																						—		
Support state enforcement of the Shoreland Water Quality Protection Act and adoption of stringent local buffer and setback requirements for development in the river corridor.															•											•													—		
Identify watershed-wide goals for fertilizer setback application.		•												•												•														—	
Include local land use boards, elected officials, municipal staff, and developers in education, outreach, and publicity initiatives related to buffers and buffer protection.	•																•																						—		
Facilitate a forum with local land use boards and developers within the region to identify potential opportunities to streamline and simplify development process to ensure environmental protection and minimize the number of exceptions granted while allowing for economic growth.		•													•																									—	—
Goal 2: Raise Awareness of Non-Point Source Pollution																																									
Support the development of ordinances that limit the use of fertilizers that contain nitrogen and/or phosphorus in the watershed.				•						•					•																								—		
Identify opportunities to engage public in ongoing water quality monitoring efforts.	•	•																								•											—			
Provide information to local land use boards and property owners about how non-point source pollution can impact water quality and habitat utilizing existing guidance and brochures. Develop additional, updated material as necessary.	•	•								•							•																						—		
Encourage local adoption of the 100 foot suggested protective standard for fertilizer and septic systems.															•																								—		
Review the stormwater ordinances and site plan and subdivision regulations of communities within the watershed and encourage consistency and adherence to regulations during site plan review and approval process.															•																										—	
Create and annually update an information sheet on new best management practices for reduction of nitrates and salt to conservation commissions and local land use boards.	•				•																																		—		
Develop an educational brochure or factsheet that summarizes the findings and recommendations of Oyster River Integrated Watershed Plan for Nitrogen Load Reductions.	•				•																																		—		
Conduct public outreach on the impact of lawn care fertilizers, leaking septic systems, and stormwater treatment.	•		•							•							•																						—		
Collaborate with UNH to identify strategies to reduce non-point source pollution from agriculture.				•						•							•																						—		

Management Issues, Goals, Strategies	Potential Partners: Local and Regional Partners: ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Town: Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	State: NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	Federal: USGS	FEMA	GBNERR	NRCS	Timeframe: Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Goal 3: Limit Water Runoff and Nutrient Transport																																								
Coordinate with local conservation commissions to review development plans for adherence to regulations including stormwater and erosion and sediment regulations, setback and buffer requirements, and open space minimum requirements.															•												•										—	—		
Identify potential threats to the Oyster River associated with development that are unregulated.																	•										•												—	
Develop and maintain an inventory of developable land within the river corridor. Collaborate with partners to prepare maps of conservation land, developed land, and developable land.	•	•																																				—		
Encourage routine, scheduled, and directed maintenance efforts of low impact development projects.			•												•						•					•												—		
Support a multi-faceted approach to reducing nitrogen that includes controls at wastewater treatment facilities, identification of failing pipes, septic systems, etc., development of ordinances that regulate the spreading of sludge on agricultural fields, and source control through stormwater management.			•																								•													—
Enhance restoration sites on College Brook and Pettee Brook to ensure that runoff and stormwater are addressed. Ensure that future restoration projects address runoff and stormwater.			•																		•						•													—
Goal 4: Maintain a Library/Reference List of Ongoing and Completed Studies of the Watershed/Region																																								
Conduct a literature review to identify studies of water quality that have been completed within the watershed by non-profits, state agencies, UNH, consulting firms, municipal public works, etc.	•			•																																			—	
Reach out to state and local partners to identify ongoing projects and data collection within the watershed and region.	•								•																		•										—			
Identify funds and/or volunteers or students to develop and maintain a well-organized and user-friendly virtual library.				•																		•																	—	—
Publicize library resources and web address through list serves, municipal websites, news articles, etc.	•																																						—	
Goal 5: Establish Instream Flow Rules																																								
Educate officials and the public about the significance of instream flow rules to protect the Oyster River flow from human activities that can have a significant impact on river dynamics.																		•		•							•												—	
Support the establishment of instream protected flows following the review of the instream flow pilot projects in 2015.				•														•		•							•													—
Goal 6: Protect Current and Future Drinking Water Sources																																								
Identify potential sources of drinking water sources such as the Spruce Hole Aquifer and ensure that water resource protection efforts adequately protect this source.																		•		•							•													—
Support the protection of current and future drinking water sources by developing a detailed map of protected areas within the watershed and identifying gaps in surface and groundwater protection.	•	•																									•												—	
Support sustainability and conservation efforts by promoting best management practices for conservation and distributing existing outreach and educational material	•																•																					—			

Management Issues, Goals, Strategies	Potential Partners: Local and Regional Partners: ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Town: Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	State: NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	Federal: USGS	FEMA	GBNERR	NRCS	Timeframe: Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Support remediation of the Tibbett's Road Superfund Site by identifying brownfield remediation funding.																		•									•														—
Support groundwater reclassification to provide local entity with the authority to enforce best management practice rules in the protected area.																					•						•												—	—
Goal 7: Monitor and Identify Hazards																																								
Support current monitoring efforts by coordinating with partners to train and recruit volunteers, identifying funding for sampling equipment, and developing outreach materials. Develop technical tools to guide water quality monitoring in the Oyster River watershed.	•																										•												—	—	
Obtain and analyze data from monitoring efforts within the watershed including USGS stream gage data, VRAP water quality data, PREP monthly sampling data, and data from relevant studies.				•																																				—
Collaborate with partners to identify additional sampling sites, data needs, and long term monitoring needs within the watershed.	•								•																		•	•											—		
Identify sensitive areas that require targeted monitoring due to their vulnerability to current and potential hazards including nitrogen, phosphorus, road salt, stormwater, and impervious surface.																											•													—	
Develop a strategy for monitoring how changes in precipitation and temperature impact water quality, water quantity, habitat, and species composition.								•									•										•	•	•											—	
Identify former industrial sites and review historical records of tanneries for potential sources of toxic chemicals.										•																	•														—
Establish pollution reduction goals for Wendy's Brook.															•		•	•																						—		
Management Issue 2: Flood Management and Remediation																																								
Goal 1: Flood Management																																								
Encourage mapping and prioritization of important flood storage areas abutting the river and its tributaries.																											•		•					•						—	
Encourage permanent protection of flood storage areas abutting the river and its tributaries through land use protection tools such as conservation easements.								•									•																						—	—
Continue collection of stream assessment data including erosion and sedimentation, vegetation loss, bank stability, and habitat loss, as part of the VRAP program. Provide an annual summary or report to watershed communities.																					•						•	•				•						—		
Review local hazard mitigation plans to identify flood hazard areas.																				•			•																—		
Conduct stream geomorphic assessment to identify Fluvial Erosion Hazard areas. Develop a fluvial erosion hazard overlay.																																	•							—
Recommend that communities adopt site plan, subdivision, and zoning ordinance regulations for stormwater. Refer to the Southeast Watershed Alliance's Model Stormwater Standards for Coastal Watershed Communities.															•																								—	—
Support modification of building standards based on revised FEMA flood maps in 2015.															•											•			•										—		
Goal 2: Maintain Stream Road Crossings																																								
Refer to the Oyster River Culvert Analysis for detailed information about how the hydrology and drainage system of the watershed are vulnerable to climate change. Communicate impacts to the existing culvert infrastructure to municipal officials and encourage proper sizing of culverts.	•												•		•		•				•																		—	

Management Issues, Goals, Strategies	Potential Partners: Local and Regional Partners: ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Town: Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	State: NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	Federal: USGS	FEMA	GBNERR	NRCS	Timeframe: Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Develop recommendations for best management practices for road crossings and a priority list of improvements for road crossings within the river corridor and watershed to support allocation of municipal funds in Capital Improvement Plans and annual budgets.	•												•		•	•	•				•																		—	
Engage property owners in monitoring flood events and impacts. Document and report rain event flooding to local officials.		•																															•					—		
Use existing data from NH DOT and Strafford Regional Planning Commission to conduct corridor site assessments to document stream crossing conditions, stream morphology, and aquatic habitat.		•		•																						•	•					•						—	
Identify strategies to reduce flooding at the Route 4 crossing over the Oyster River and Caldwell Brook.															•						•								•											—
Assist with the development and implementation of flood remediation at Cherry Land and Hayes Road crossings.															•											•														—
Goal 3: Identify and Maintain Major Flood Storage Areas																																								
Evaluate the adequacy and consistency of existing water storage protection measures across local zoning ordinances in the watershed.	•								•																														—	
Review updated FEMA flood plain maps to identify additional storage areas.																		•			•																		—	—
Identify and map areas where new flooding occurred during large storm events.																				•																	—	—		
Present information to elected officials about the importance of preserving flood storages areas to protect public and private property.	•	•													•																						—			
Develop maps for watershed communities that display key wetland and uplands that provide storage.		•															•																						—	
Conduct outreach to property owners within the watershed about the importance of preserving wetlands and uplands.	•				•												•									•	•										—		
Support local regulations such as open space or conservation subdivisions to preserve key wetlands and uplands within the river corridor and watershed.		•															•									•													—	
Goal 4: Inventory and Maintain a Record of Impervious Surfaces																																								
Compile existing impervious surface data.	•	•					•																															—		
Refine impervious surface cover maps as new data becomes available.		•					•																																—	
Create a database to track impervious surface data associated with new development within the corridor		•																																				—		
Goal 5: Maintain River Buffer and Proper Channels																																								
Promote buffer protection through ordinances that regulate development and encourage implementation of best management practices.															•																								—		
Identify and map areas where erosion and sedimentation problems are present. Develop a list of prioritized projects to mitigate erosion and sedimentation.	•	•																								•	•												—	—
Promote proper culvert sizing, replacement, and appropriate design standards to accommodate future changes in precipitation using the Oyster River Culvert Analysis.									•						•			•								•													—	—
Goal 6: Reduce Man-Made Runoff																																								

Management Issues, Goals, Strategies	Potential Partners: Local and Regional Partners: ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Town: Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	State: NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	Federal: USGS	FEMA	GBNERR	NRCS	Timeframe: Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Support municipal adoption of site plan regulations that require adoption of Low Impact Development (LID) site planning and design strategies to the maximum extent possible for new development, as required in Durham.			•												•												•													—	—
Collaborate with the UNH Stormwater Center and Cooperative Extension to provide outreach and education to homeowners about minimizing runoff through methods such as rain gardens, rain barrels, and reducing impervious surface.			•		•																						•												—		
Encourage municipalities within the watershed to incorporate LID and best management practices for reducing runoff into Capital Improvement Plans. Identify funding sources for planning and installation of LID.															•	•		•									•											—			
Provide developers with information about the importance of minimizing impervious surface cover and implementation strategies to do so.	•																										•											—			
Collaborate with UNH to identify appropriate stormwater runoff mitigation at the Lee Traffic Circle.			•																											•												—
Management Issue 3: Land Protection, Resource, and Habitat Conservation																																									
Goal 1: Habitat Conservation																																									
Encourage permanent protection of land abutting the river and its tributaries through land protection mechanisms such as conservation easements.	•	•						•									•											•								•			—			
Collaborate with conservation commissions within watershed communities to identify priority parcels to conserve.	•	•						•									•											•								•				—	—
Education property owners about incentives for conserving land.	•	•			•			•									•											•								•			—			
Identify opportunities to finance land acquisition.	•	•						•									•											•								•				—	—
Encourage zoning ordinances and overlay districts that limit the impact development of land abutting the river and its tributaries.	•	•						•									•											•								•				—		
Organize and support education activities that raise awareness of habitat conservation and/or restoration. Develop educational material and identify community events to attend and distribute information.	•	•			•			•									•											•								•			—			
Goal 2: Identify and Protect Wildlife and Aquatic Habitat																																									
Utilize existing technical studies including The Land Conservation Plan for New Hampshire's Coastal Watersheds and the New Hampshire Wildlife Action Plan and the map set for this plan to identify significant wildlife habitat.		•							•																			•												—		
Identify key species' habitat requirements and threats to the integrity of these habitats such as sedimentation and erosion, nonpoint source pollution, and inadequate culvert size.																											•	•														—
Support the establishment of instream protected flows following the review of the instream flow pilot projects in 2015.																											•							•								—
Identify strategies to improve fish passage on Dube Brook. Seek funding and volunteer support for restoration.										•																	•	•				•										—
Investigate potential dredging needs in Mill Pond to address sedimentation.														•													•														—
Management Issue 4: River Corridor and Watershed Planning																																									
Goal 1: Collaboration and Engagement																																									

Management Issues, Goals, Strategies	Potential Partners: Local and Regional Partners: ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Town: Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	State: NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	Federal: USGS	FEMA	GBNERR	NRCS	Timeframe: Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Develop a list of stakeholders and partners.	•																																					—		
Establish a process for expanding dialogue about water resource protection and threats in watershed communities.	•																																					—	—	
Meet annually with local land use boards to discuss watershed-wide opportunities, challenges, and best practices to balance economic development and growth with water quality preservation.	•																																			—			
Partner with NHDES, UNH Stormwater Center, UNH Cooperative Extension, and others to coordinate and conduct trainings and provide information about a suite of watershed management issues including land and resource protection regulations, emerging science and technology, and best management practices and success stories	•		•														•		•							•													—	—
Goal 2: Enhance and Provide Technical Assistance																																								
Identify resources to support ORWA member attendance at workshops and trainings.	•																																					—	—	
Refer to resources including NHDES's Innovative Land Use Planning Techniques: A Handbook for Sustainable Development, EPA's Handbook for Developing Watershed Plans to Restore and Protect Our Waters, and resources available at the Center for Watershed Protection website to identify strategies to encourage adoption of innovative land use controls.	•	•		•											•																									—	—
Meet with municipal staff and planning boards to discuss regional mapping needs. Collaborate with Strafford Regional Planning Commission to develop watershed maps.		•													•																								—		
Support correction of Dube Brook Oyster River hydro-annotation.	•																																	•							—
Goal 3: Inventory Current Development Regulations																																								
Refer to this plan and local planning and zoning documents to develop a summary of current development regulations, review regulations for consistency/variation by Town and State, and to identify gaps in regulations.	•	•							•						•																									—	—
Identify strategies to simplify and standardize development regulations within the corridor and/or watershed.	•								•						•																									—	—
Communicate recommendations for development regulations to local officials.	•														•																								—	—	
Goal 4: Inventory and Protect Cultural Resources																																								
Prioritize the protection of cultural resources identified in this plan.	•	•		•								•											•							•										—	
Survey community members to identify cultural resources they value.	•	•		•								•						•												•										—	—
Develop a guide of cultural resources to distribute to watershed communities. Identify resources that are publically accessible. Identify resources that are vulnerable to development or changes in land use or river flow.	•	•		•								•											•							•										—	—
Work with UNH to establish a database of scientific research projects that have occurred on the river or within the corridor.	•	•		•																																				—	
Goal 5: Inventory and Promote Recreational Resources																																								
Collaborate with conservation commissions to develop detailed maps of recreational resources within the corridor and watershed.		•		•													•						•	•							•									—	—	
Identify threats to recreational resources, including impacts to boating and recreational activities due to silting in the tidal portion of the Oyster River resulting from upstream activities.	•	•															•									•	•														—
Develop a guide of recreational resources to distribute to watershed communities.		•															•							•		•															—

Management Issues, Goals, Strategies	Potential Partners: Local and Regional Partners: ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Town: Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	State: NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	Federal: USGS	FEMA	GBNERR	NRCS	Timeframe: Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Goal 6: Catalog Existing Data and Resources and Identify Data Needs																																								
Continue to collect and compile data on river corridor and watershed conditions.	•	•		•					•																	•											—			
Identify new sources of data and data needs.	•								•																	•												—	—	
Ensure that data and information about the watershed and corridor are available on or through the ORWA website.	•			•					•																													—		
Encourage watershed communities to complete National Resource Inventories and assist communities with applying for grants to fund these studies.	•	•															•									•													—	—
Goal 7: Protection of Great Bay/Piscataqua Region																																								
Collaborate with other local watershed associations and organizations to identify common and unique river management issues.	•							•	•																	•	•												—	—
Collaborate with other local watershed groups to review consistency or local regulations, planning and management needs, and data needs across management within the Great Bay/Piscataqua River watershed.	•								•								•									•	•												—	—
Identify threats to the Oyster River and watershed associated with land use, activity, or groundwater contamination outside the watershed.	•								•																	•													—	—
Identify habitat improvement or restoration needs within other watersheds that impact the quality of habitat in the corridor and watershed.	•							•									•									•													—	—
Goal 8: Raise Awareness of the River Management Plan																																								
Encourage adoption of all or part of the River Management Plan as part of the Master Plans of each watershed community. Facilitate adoption by providing copies of this plan to Land Use Boards and elected officials and presenting threats and management needs and recommendations to Land Use Boards and elected officials.	•	•													•											•														—
Identify a watershed coordinator to facilitate the development of a publicity plan to advertise the plan, to communicate the implementation of management issues, goals, and strategies in this plan, and to publicize success stories and achievements.	•																																					—	—	
Develop a database of diverse media outlets and list serves to publicize the plan and future events.	•																																					—	—	
Coordinate the release of the plan with a watershed wide gathering or stewardship event and present major goals, threats, and management and volunteer needs.	•																																					—	—	
Management Issue 5: Stewardship, Education, and Outreach																																								
Goal 1: Raise Awareness of Stewardship Activities																																								
Develop an outreach campaign to raise awareness of stewardship activities within the watershed.	•	•																																					—	—	
Identify and acquire funding to develop and implement education and outreach activities.	•	•																																					—	—	
Identify new groups and organizations to engage.	•																																					—	—	
Promote stewardship by river users and riparian property owners by establishing a sponsorship program for river and tributary segments to provide an opportunity for local volunteer and civic groups to participate in ongoing cleanup efforts.	•																•																						—	—	
Goal 2: Enhance Website																																								

Management Issues, Goals, Strategies	Potential Partners: Local and Regional Partners: ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Town: Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	State: NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	Federal: USGS	FEMA	GBNERR	NRCS	Timeframe: Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Develop ORWA website to facilitate outreach and education, dissemination of information, and promote river related events and projects.	•																																					—	—	
Provide links to partners, relevant studies and data, and best management practices.	•																																					—	—	
Publicize maps on website.	•																																					—	—	
Solicit website development assistance from UNH students.	•			•																																		—	—	
Goal 3: Outreach via Pamphlets																																								
Create and distribute pamphlets that highlight identified and prioritized concerns such as fertilizer use in the watershed to watershed communities.	•																									•												—	—	
Establish clean, consistent messaging for communicating about threats to water quality and habitat.	•																									•												—	—	
Seek funding sources for outreach activities.	•																									•													—	
Goal 4: Communicate Watershed Activity to NHDES																																								
Continue to produce annual water quality monitoring reports.																										•											—			
Comment on developments within the corridor or watershed and provide recommendations to NHDES.																										•											—			
Goal 5: Promote Regulatory Consistency and Enforcement																																								
Review and compare consistency of zoning and overlay districts in watershed and corridor communities.	•														•																									—	—
Utilize existing studies, state recommended standards, and research of best management practices to evaluate the effectiveness of current zoning and overlay districts.															•											•													—	—
Collaborate with conservation commissions to review and comment on proposed development that may negatively impact the river and corridor.																	•																						—		
Evaluate enforcement behavior and variance practices. Encourage planning boards to limit exemptions.	•														•		•																						—	—	
Recommend watershed-wide minimum standards for protection of the watershed.															•																										—
Goal 6: Promote Non-Regulatory Solutions																																								
Educate property owners and municipal officials about voluntary strategies to mitigate the impact of human activity on the river and river corridor.																										•													—		
Increase public awareness of the importance of buffers by collaborating with UNH Cooperative Extension to present and distribute information about landscaping with native species and shade trees and providing riparian habitat.					•													•																				—	—	
Identify accessible and highly visible locations for demonstration projects such as parks or schools that model best management practices for landscaping including buffers and rain gardens.				•																																				—
Encourage municipal Department of Public Works participation in Green SnowPro training and certification to reduce salt application.						•																																	—	—	
Goal 7: Educate about Costs and Cumulative Impacts and Threats to the River																																								

Management Issues, Goals, Strategies	Potential Partners																																						Timeframe			
	Local and Regional Partners															Town												State							Federal								
	ORWA	SRPC	UNH SC	UNH	UNH Coop Ex	UNH T2	GRANIT	Cons Orgs	PREP	Ag Groups	Trout Unlimited	Historical Assoc.	Engineer	VHB	Planning Board	Town Admin	Cons Comm	Planning Dept	Water Board	Emergency Mgmt	Public Works	Libraries	Road Agent	Econ Development	Parks and Rec	Code Enforc.	NHDES	NH FG	NH OEP	NHDOT	Historical Resources	NH DRED	NHGS	USGS	FEMA	GBNERR	NRCS	Ongoing	Short Term 1-2 yrs	Mid Term 2-5 yrs	Long Term 5-10yr+
Review local and national case studies of best practices for watershed management to identify examples of cost savings associated with protection of water quality and quantity.	•																									•												—	
Work with public works departments to identify costs associated with treating drinking water.																		•	•		•					•												—	—
Conduct a literature review and compile information about ecosystem services and the monetary and nonmonetary benefits provided by the river and watershed to incorporate into educational and outreach material.	•			•																						•								•				—	—
Educate land use boards about the cumulative impact of development and human activities on the river and corridor.	•	•													•											•												—	
Develop and provide informational resources on current and future impacts of development to developers.	•																																					—	—

Chapter VII: Summary

Summary

Goals and Vision of the Plan

The Oyster River Management Plan has been developed with the goals of protecting and conserving the river's many resources; protecting riparian and aquatic habitat; advocating for water quality and quantity to sustain aquatic and recreational uses; and balancing economic development with protection of land and water within the river corridor and watershed.

The Oyster River Local Advisory Committee (ORLAC) will advocate for implementation of the Plan within the watershed. ORLAC supports integration of the Plan's goals and strategies by communities in the Oyster River watershed in planning initiatives and land use decisions.

Review of Findings

Chapter VI: Priority Management Issues, Goals, and Implementation Strategies recommends specific strategies to address preservation, conservation, and sustainability of natural resources in the river corridor and watershed. These strategies address the challenges of land use change and growth in the watershed by:

- Conducting evaluations to help identify land use change, analyze trends, and determine the ecological impacts and cumulative effects of land use change
- Supporting technology, research, and information gathering, analysis, and dissemination
- Coordinating with watershed partners, local officials, and land use boards to implement and enforce effective protection measures
- Reaching out to the public for their support and stewardship in the watershed.

Summary of Plan Actions

The following priority management issues were identified during development of the Oyster River Management Plan. These issues are the focus of the implementation strategies explained in detail in Chapter VI and Table 46.

I. Water quality and Quantity Protection
II. Flood Management and Remediation
III. Land Protection, Resource, and Habitat Conservation
IV. River Corridor and Watershed Planning
V. Stewardship, Education, and Outreach

Review and Updating of the Plan

The Oyster River Management Plan will be reviewed annually and updated every 3-5 years depending upon need and subsequent recommended changes in the Action Plan, and changes in local and state regulatory requirements and development trends.