CHAPTER 6 – NATURAL RESOURCES

Introduction

Natural resources impact development in many ways. Resources such as wetlands, forests and shorelines place limitations on development. Similarly, development impacts natural resources. Development can affect the quantity and quality of drinking water, the condition of soils, and the wellbeing of wildlife and plant life. The balance between preserving our natural resources and developing our land is delicate and a vital function of long-range planning. The consideration of development and natural resources and the associated social and economic implications give rise to the following challenging questions:

- What are the economic, environmental and social costs and benefits of our long-term planning for growth?
- How will the town preserve its working landscape of horse farms, open areas, saltwater marshes and forests in the face of population growth and development pressures?
- How can our natural resources be utilized for recreational and educational opportunities, without degrading the very resources we seek to protect?
- How does the day-to-day work of town Boards and Commissions affect the longer-term management of our natural resources?

To discuss these questions, we need to appreciate the significant threats to natural resources, we need to evaluate the current data available, and we need to utilize the planning and legal tools available for management of natural resources.

We must also consider the views of the community, as expressed through the Master Plan Visioning Process, town surveys, and town warrant articles, as we seek to formulate goals and strategies for natural resource management. This chapter will begin with a discussion of the views expressed by the members of the community, followed by a discussion of threats to natural resources and an analysis of existing resources. We conclude with recommendations for goals and strategies for natural resource management.

The following table summarizes the main issues raised and includes representative comments from individuals who attended the sessions.

Master Plan Visioning Process

The opinions expressed in the visioning sessions demonstrate that the many residents of Rye recognize the challenges they face in addressing natural resource concerns and can formulate a number of solutions to address these issues. Many of the concerns mentioned have been worked on and improved, such as, keeping our beaches clean, maintaining our scenic views, improving our marshes and wetlands, preserving more open space, increasing our bike paths, providing senior housing and repairing the sidewalks on Cable Road. These visioning sessions have provided benefit for the Planning Board and should be continued in the future.

Table summarizing the Main Issues:

Issue	Comments from Individuals Who Attended
1. Beaches/ waterfront	• Keep beaches clean • Control dogs on the beach, ban dogs from the beach • Reclaim harbor, Jenness Beach, Wallis Sands for Rye • Encourage non-motorized craft on designated waterways and roadways, ban jet skis
2. Wastewater disposal issues	• Concern about discharge into the ocean, silt, sewer system and fresh water management • Question capacity of existing resources to support increased population
3. Air pollution/ Noise pollution	• Concern about locally, regionally, and nationally generated pollution
4. Scenic views /Quality of life	• Maintain and enhance scenic views • Natural resources enhance quality of life • Open space creates atmosphere of small town • Cell tower effects on natural resources/aesthetics
5. Wooded lots	• Purposes are viewing, noise mitigation, issue of burning wooded lots/forest management
6. Wetlands	• Need for stricter enforcement of wetlands regulations • Let Rye be more strict than the NHDES requirements
7. Marsh lands	• Enhance the flushing of marshlands/ roads issue
8. Open space	• Open space should be visible/frontage • Consider incentives for private owners • Allow for creativity in site design/subdivision for open space • Investigate real estate transfer tax to “Rye land bank” for purchase and maintenance of open space • Consider seniors leaving their homes and selling land for development—need empty nest housing • Continue funding for open space • Restrict back lot development
9. Wildlife/ corridors/ greenbelts	• Maintain wildlife corridors to provide habitat, visual & sound barrier, and wind protection • Monitor development until wildlife corridors are clearly established and protected • Control mosquitoes • Improve pest control issues such as ticks/deer
10. Paths and sidewalks	• Repair sidewalks on Cable Road. • Consider need for bikeways, bike paths • Need walkways to school, library • Prefer permeable surface paths for bikes, runners, cross-country skiing, walking. • Link the two schools with paths

1.0 IDENTIFYING OUR MOST IMPORTANT NATURAL RESOURCES

It is important to identify our most important natural resources. What makes us different from other New Hampshire towns? First, our beaches are probably the most important natural resource. Second, Rye is known for its rural town concept and abundance of open space. Our citizens have supported the extra cost of providing open space. Third, since Rye is located in Rockingham County, one of the fastest growing counties in the state of New Hampshire, having an adequate water supply is very important for the future growth. Our water system is adequate and is supplied by town wells.

2.0 UNIQUE COASTAL RESOURCES

A. Description of Beaches

Rye has six beaches and sand dune areas totaling 87 acres starting at the town line of North Hampton, as described under C. The dunes areas have been developed for many years, but the beaches appear to be well protected from development by the town's floodplain and wetland regulations and by the NH Wetlands Board.

B. Protecting Beach Access

Accesses to the beaches have been an area of concern for many years and some of the access points have been lost to the Town and public due to court battles, encroachments and lack of maintenance. In 2011, a study was conducted on beach access points and a Power Point presentation was presented to the Selectmen on two different occasions. See minutes of the Selectmen meetings to learn more about the presentation on the Town Website at http://www.town.rye.nh.us/pages/RyeNH_SelectMin/BOS_Minutes_9-26-11.pdf.

C. Balancing The Right of all who use the Beach

The Selectmen approved signage to be placed at the approved beach access points located at

- **Bass Beach** – Access onto Bass Beach on the town line of Rye and North Hampton and there are two signs, one to name the beach, the other for "Beach Access",

- **Philbricks Beach** – Access onto Philbricks Beach south of the Beach Club and there are two signs, one to name the beach and the other for "Beach Access";

- **Sawyer's Beach** – This beach has two (2) signs for this beach at both ends of the beach; each location has two signs, one to name the beach and the other for "Beach Access". This beach is town owned. Parking is limited to residential beach permits only;

- **Jenness State is partly owned by the state and partly by the Town. The portion owned by the State has a parking lot and posted by the State;**

- **Jenness Beach (the Town owned portion)** – has multiple access points as follows;

E Street – Foot path across from Rye General Store and has two signs, one for the access name and the other "Beach Access";

F Street – Has access to the beach at the end via pedestrian foot traffic only.

G Street – Originally designated as a Beach Access than later discovered this is a private Right-of-Way and the signs were removed; although the residents do not mind foot traffic only to the beach.

Cable Road – Is a public road and has access to the beach at the end with beach permit only parking along the side. There are two signs at this location, one to name the street and the other for "Beach Access";

Sunrise Path – Is a public right-of-way, gravel path with access to the beach and parking on one side. There are two signs at this location, one to name the street and the other for "Beach Access";

Old Beach Way – Is a public right-of-way, gravel path with access to the beach and with beach permit parking on one side. There are two signs at this location, one to name the street and the other for "Beach Access";

Old Town Way – Is a driveway for the residents and a footpath only for the area as per Superior Court order, September Term, 1986, No. E-275-91. There is no signage at this access.

- **Foss Beach** – is a long stretch of beach that runs from Rye Harbor State Park, along Ocean Boulevard just past Washington Road. There are wooden ramps to access the beach and there are two signs along the beach, one to name the beach and the other for "Beach Access";

- **Concord Point** – Just north of Concord Point Road is a gravel road for beach parking and has two signs at this location, one to name the location, the other for "Beach Access";

- **Wallis Sands Beach is partly owned by the state and partly owned by the Town. The portion owned by the State has a parking lot and posted by the State;**

- **Wallis Sands Beach (the Town owned portion)** – May be accessed from Wallis Road. There are two signs at this location, one to name the street and there is parking by beach permit only and the other sign for "Beach Access";

(It should be noted that Cable Road and Wallis Road no longer have extensions. These were omitted by the 911 Committee for safety reasons)

There are many other small access points to the Atlantic Ocean along Ocean Boulevard which is a state highway, maintained by the state. These access points are mostly paved turn off's and some have either one or two hour parking limits.

During the past 10 to 15 years, there has been a growing concern over the ownership and increased use of the beaches that are not owned by the State of New Hampshire and are fronted by both seasonal and year round residences. Eventually, this situation ended in a court case brought before Superior Court in 1999. The outcome of case #95-E-0455, G. William Purdy and others, versus the Attorney General of New Hampshire was that the limit of the public's rights to the beach under the Public Trust Doctrine is mean high tide.

It is important that all parties, the Town of Rye, the beachfront property owners and the public cooperate so that all may enjoy the use of the beaches without infringing on the rights of other parties.

Rye Harbor

In addition to our beaches, another important natural resource and tourist attraction is Rye Harbor. It is an inlet from the ocean that has been improved by the addition in 1939 of jetties consisting of large granite blocks. Dredging this location gives added protection from the open sea to our fishing and recreational boats.

Rye Harbor also has a long tradition of providing employment opportunities such as lobstering, fishing, whale watching, boat maintenance, and other jobs typical of a small seaport.

There are 160 moorings with 53 designated for commercial fishermen. These commercial moorings can only be transferred to other commercial fishermen. As of 2013, there is a long list of approximately 170 individuals waiting for available moorings. The management of Rye Harbor is provided by the New Hampshire Port Authority under the auspices of the State of New Hampshire.

D. Coastal Storm Concerns; Protecting Rye Citizens from the affects of Global Warming and increased coastal storms

Our ocean frontage may be our most important natural resource, but it also presents a great risk to our citizens with damage to our seawalls, shore roads and beachfront properties. With concerns about global warming and increased coastal storms, we can expect conditions that we faced during the famous storm of 1978 to occur again, and we must be prepared for it.

Rye Floodplain

Rye is blessed with an abundance of shoreline which adds to its attractiveness as a place to live or just spend the day. The shoreline with its beautiful beaches brings along a risk of coastal flooding during storm events. These storms will take the form of an old fashioned nor'easter, tropical hurricane, or just a large rain event.

Rye's 500 plus homes located within the floodplain or the High Hazard Flood Area are at risk of flooding during these events. The High Hazard Flood Areas are shown on FIRM maps developed by FEMA as part of their flood insurance program. The flooding here in Rye may take a couple of different forms. The first will be a tidal surge or waves that wash over the protective dunes or barriers up to one foot deep and then flowing inland to the marshes. This sheet flow will exert forces on the foundations of buildings and cause erosion of the barriers and the land around buildings in its path. The other will be a rise in the water level of the marshes which will cause homes along the edge of the marshes to become submerged or maybe even float off their foundations.

In 1988 Rye adopted a "Floodplain Building and Development Ordinance" to help mitigate these hazards. The ordinance requires that all new construction or substantial improvements be raised above and protected from the flood event. Homes built to the requirements of the floodplain ordinance will be better suited to withstand the effects of a flood event.

Rye citizens may need to plan on maintaining the barriers that keep the ocean from causing more damage. Many of these barriers are under private ownership with very little oversight. Others take the form of the rubble rock barriers (shale piles) that are along Ocean Boulevard. These shale barriers were built by the State and are maintained by both the State and the Town. Considering the value of real estate that is protected by these barriers it may be time for the Town to take a more active role in their construction and maintenance. It is also important to insure that construction does not block the natural flow of storm waters from the marshes to the ocean. Investigations may need to be performed to see if any changes to the flow patterns during a flood event are needed to mitigate elevated water levels.

E. Areas of Scenic Importance

The State Coastal program has identified seven (7) areas of coastal scenic importance in Rye. These seven areas include the Isles of Shoals, Rye Harbor, and all scenic sections of Ocean Boulevard. These areas appear protected from development which would encroach upon scenic attractions by local and state wetlands and the floodplain regulations and by state ownership of Rye Harbor, Odiorne Point, the Ocean Boulevard right-of-way and all ledge below the mean high tide line.

F. Other Unusual Areas

The state coastal program has also identified eight areas in Rye that have uniqueness or character which set them apart from other categories of coastal resources. These areas are:

1. Little Harbor
2. Berry's Brook Estuary (i.e. the Berry's Brook-Bellyhack ecosystem)
3. Fairhill-White Cedar Swamp
4. Odiorne State Park
5. Eel Pond/Cedar Swamp Run
6. Burkes Pond (and Browns Mill pond)
7. Rye Ledge
8. Isles of Shoals

These areas all appear well-protected by the state and local regulations previously described herein. The exception is Berry's Brook, which is a unique ecosystem threatened with development encroachment from within the Portsmouth portion of the watershed.

3.0 PRESERVATION OF OPEN SPACE

The majority of Rye Citizens support the preservation of our rural town. This was evident when Rye voters enthusiastically supported the purchase of Parson's Park and Parson's Woods. Again in 2003, the five (5) million dollar bond issue was approved, and the Open Space Fund was established. By the close of 2012, we will have completed the purchase of fourteen (14) easements, thereby protecting over 238 acres for $4,414,000. We have also purchased more than 200 acres for $4,684,900. This was accomplished by leveraging other owned land and grants from the capital NOAA, federal wetlands, and farm and ranch land grants. This means that the conservation land protected is over 1,030 acres. We will have received more than $4,100,000 in gifts of lands, donations, and grant assistance.

There are additional Rye land owners who wish to grant conservation easements on their farmland and open space. Since our original five million dollar bond issue is mostly spent or committed, do Rye Citizens want to continue this successful project?

A. The Goss Farm

The Goss Farm, (corner of Harbor Road and Ocean Boulevard), has been owned and farmed by the same family since the 1700's. The property was purchased in 2010 for the Town of Rye with funds from the Town and assistance from the U.S.D.A National Resources Conservation Service and through a farm and ranch land program award. Our Conservation Commission manages the nine (9) plus acre property, and a conservation easement is held by the Rockingham County Conservation District. There is one structure on the property, the historic Goss Barn that is listed in the New Hampshire State Register of Historic Places and is in need of restoration. A new metal roof was installed in 2012, and there is also foundation, structural and drainage work to be done. The necessary funding has been provided by approval of Article 6 of the 2013 Warrant in the amount of $170,000 for completion of the Goss farm barn restoration.

The main purpose of owning the property is to promote local agriculture. The programs that are in progress are to establish a Community Supported Agriculture (CSA), creating community garden plots, and providing an area for Rye schools to educate children about agricultural practices. Since the property is adjacent to wetland meadows and salt marshes, buffer areas have been established to protect runoff from the proposed farming areas.

The Goss Farm provides an opportunity to connect with and preserve farming traditions of the past.

B. Forest Land Resources

The Town of Rye has numerous forest areas on both private and public properties. Two large areas are the Town forest known as Parson's Woods, (accessible from Washington Road), and the Varrell Woods, (accessible from Parson's and Recreation Road). Both areas contain trails that are well used by our citizens. Every day many people use these trails for exercise and dog walking. During the winter, the trails are used for skiing and snowshoeing. Both areas are protected by a conservation area easement, managed by the Rye Conservation Commission and supervised by the Rockingham County Conservation District.

The Town forest is used by the Rye schools as part of their natural study program. The forest also offers wildlife corridors. Securing these corridors is an important goal of the Rye Conservation Commission. Other unique forest areas include the Odiorne State Park and the Atlantic White Cedar Preserve on Cedar Swamp Run that were gifted to the Nature Conservancy.

The Rye Conservation Commission has a forest management plan.

C. Odiorne Point State Park

Rye is fortunate to have Odiorne Point State Park that helps to preserve our open space and includes 330 acres of coastal land and water along Route 1-A. The park includes walking trails, picnic areas, and the Seacoast Science Center. Wildlife habitat at the park includes salt water marshes, rocky shores, upland shrub forest, meadows, salt and fresh water ponds, and beach dunes. In addition to its natural amenities, the park also contains historical and cultural resources such as the remnants of World War II military structures, cellar holes and stone walls. The Park is operated by the Division of Parks and Recreation, with the exception of the Seacoast Science Center, which is a public/private partnership managed by the Audubon Society under contract with DRP in affiliation with the Friends of Odiorne Point State Park and the Seacoast Science Center, Inc., and the University of New Hampshire Sea Grant Program. These groups are each represented on the Seacoast Center Advisory Committee, which is responsible for overseeing the activities of the Center.

The Science Center is host to over 100,000 visitors a year as well as school groups and day campers. The Center's activities include educational programs, field and interpretive programs.

In addition to its ownership and management of the coastal areas of the Park, The Division of Parks and Recreation also owns and manages White and Seavey Islands, which are two of the islands of the Isles of Shoales. Habitat restoration projects have been sponsored on the islands by Audubon and the NH Fish and Game Department.

Both the natural and cultural history of this unique area of Rye have been well documented and can serve as useful resources for the citizens of Rye in formulating strategies to restore habitat, protect natural areas, and respond to impacts to natural resources occurring as a result of residential and commercial development. More information on the wildlife habitat, natural history, and cultural history of the Park can be obtained from the Seacoast Science Center and in

The Odiorne Point State Park and White Island Master Plan (1999) and the Management Plan for the Cultural Landscape Features of Odiorne State Park (2002). Several documented habitat inventories and related studies have also been conducted in the Park by university graduate students, professional consultants, and volunteer naturalists.

The New Hampshire Islands of the Isles of Shoals are included in the Rye Historic District. The Rye Historic Commission is tasked with preserving the cultural, economic, social, political, and architectural history of the Rye Historic District. This multi-disciplinary approach to managing and protecting resources which are both natural and historic highlights the important connections between our green, built, and social infrastructure, as discussed in the introduction to this chapter.

D. Salt Marsh Restoration Projects

Salt marshes are the transition zone from the ocean to the land. In this zone, fresh water and salt water mix. Salt marshes are very productive ecosystems despite wide fluctuations in salinity, water flow, temperature, and oxygen levels. Plants that live in the salt marsh are salt tolerant. Salt marsh zonation results from species adapting to particular physical and chemical conditions in different areas of the marsh.

The influence of tides is crucial to the productivity of the marsh, carrying in nutrients for plant growth and carrying away some organic material. Remaining organic material accumulates and becomes peat (NES, 2004).

Assurance of uninhibited salt marsh tidal flow is critical to protecting the ecosystem. Every reasonable effort should be made to protect the tidal flow. Where tidal flow has been restricted to salt marsh areas we should promote implementing actions to reclaim the restricted area to their original state.

Due to zonation, four distinct areas of plant growth can be observed when looking out across a salt marsh: the low marsh, the high marsh, panes and pools, and the upland border.

<u>The following salt marshes have benefited from ongoing restoration projects:</u>

- Parson's Creek Marsh: off Wallis Road - year of project 1997-1999
- Fairhill Marsh: west of Wallis Sands State Beach - year of project Phase I 1997, Phase II 2004
- Awcomin Salt Marsh: year of project 2001-2003
- Massacre Marsh: off Brackett Road - year of project 2003 ongoing

E. Berry's Brook – Bellyhack Ecosystem

Berry's Brook has a total stream length of 6.2 miles, of which the easternmost 1.0 miles is tidal. It has a mean flow of 7.8 cubic feet per second. The Berry's Brook drainage basin is 5.9 square miles in area. Approximately 55 percent of the drainage basin is in the Town of Rye; 40 percent in the City of Portsmouth, and 5 percent at the headwaters at Breakfast Hill in the Town of

Greenland. The following is excerpted from the Berry's Brook Water Quality Management Plan (WQMP. P 28-29

> The Berry's Brook-Bellyhack Bog ecosystem is an area of great natural beauty and has prime importance as a healthy and functional wetlands system comprising upland drainage, feeder streams, an estuary and a tidal marsh. Its biological productivity is exceptionally high in abundance and diversity of plant and animal species. A study of this ecosystem offers one an education in the dynamics of the energy-food web upon which we are all dependent in the broad sense as well as in a strict sense. The latter refers to the fish and shellfish that can be caught or gathered in modest but adequate amounts for many families to enjoy. For example, seasonal smelt and flounder fishing is often excellent in the tidal area.
> Berry's Brook has the only sea run brown trout population in New Hampshire. The marsh area is a haven for shore birds and waterfowl. Kingfishers, Great Blue Herons and Snowy Egrets can be frequently observed from the Brackett Road Bridge. The waters of Berry's Brook contain an abundance of aquatic vegetation that provides food and shelter to many other species and also contributes to the estuarine detrital reservoir…. This is the first step in the food chain, which ultimately provides for the fish, shellfish, birds, and mammals indigenous to this estuary, many of which are transient or seasonal (e.g. the sea run brown trout). If the primary producers in the food chain, the green photosynthetic plants of the wetlands, are destroyed or rendered unhealthy, eventually the whole system will breakdown and become more limited in productivity. One of the most tangible results of the degradation of ecosystems such as this to the ultimate consumer—humans—is that most of the shellfish and fin fish which depend wholly or in part on the estuarine-marsh system for their life cycles become increasingly scarce and costly.

In 1990, the Rye Planning Board and the Portsmouth Planning Board began an inter-municipal effort of watershed protection planning for the Berry's Brook watershed. The Berry's Brook Watershed Protection Council was organized, and grant assistance from the State coastal program was used for the preparation of eight planning base maps of the watershed. The base maps portray, respectively, the study area, zoning, wetland soils, parcel ownership, slopes, aquifers and utilities within the watershed.

In late 1992, further coastal program grant assistance was received for the preparation of a Watershed Management Plan for Berry's Brook. The Berry's Brook Watershed Management Plan was completed in June 1993. The plan report contains a detailed inventory and analysis of the watershed, a build-out analysis and an action plan for watershed management.

In 1995, with the assistance of a NH Coastal Program Grant, water quality testing was accomplished at eight locations along Berry's Brook during April and May 1995. Level of bacteria and hazardous compounds were low and did not pose any health problem. The Public Works Director maintains further testing as part of the NH DES Storm Water Phase II annual permit process.

F. Wetlands

Rye has approximately 7 miles of coastline with tidal and fresh water wetlands comprising approximately 38 percent of Rye's total land. Today, the coastline, estuaries, salt and fresh water marshes, and wetlands are protected by Federal, State, and local regulations. Protection is given to Rye's wetlands by state regulation of wetlands administered by the New Hampshire Wetlands Board, which requires that anyone planning to excavate, remove, fill, dredge or construct within a wetland obtain a permit from the Board. The Rye Conservation Commission reviews all applications for state wetlands permits. Environmental impacts are assessed for each requested permit affecting these protected areas and their associated buffer zones.

Much of the wetlands in the town of Rye is on town-owned land (i.e. Town Forest, Varrell Woods, Seavey Acres) and is preserved and made available for limited public use. Scenic hiking and walking trails are maintained with good forest management practices for healthy forest growth and wildlife habitat. Select parcels of land will continue to be acquired for conservation and public use through gifts of land and outright purchases. The objective is to provide additional protection for Rye's marshes, streams, ponds, and selected forested areas. It also provides for larger contiguous wildlife habitats. In 1996, Varrell Woods was acquired, a significant parcel adjoining Awcomin Marsh and the Town Forest.

There are 7 major systems of wetlands in Rye:

1. Berry's Brook – Bellyhack Bog
2. Witch Creek
3. Fairhill Swamp
4. Concord Point Drainage Basin
5. Awcomin Marsh
6. Rye Harbor Marsh
7. Cedar Swamp Run (aka Bailey Brook)

Of these, studies have found the Berry's Brook – Bellyhack Bog system to be the most pristine and the Concord Point Drainage Basin to be the most threatened. In 1993, the Berry's Brook Watershed Protection Council developed the Watershed Management Plan for Berry's Brook, prepared by Appledore Engineering, Inc. The Plan includes an extensive inventory and analysis of watershed resources, a discussion of threats to watershed resources, a build-out analysis, and an action plan of regulatory and non-regulatory strategies. The Plan rests on seven key policies to protect the watershed and its natural resources through an inter-municipal management framework.

The Conservation District of the Rye Zoning Ordinance, which was enacted in 1989, also protects wetlands. The Conservation District is a use district, which includes most of Rye's salt marshes within its boundaries. The uses permitted in the Conservation District include forestry, conservation, aquaculture, trail, nature centers, and wildlife viewing blinds. Commercial, business, industrial and residential uses are prohibited.

G. Wildlife Corridors

The Town of Rye contains several wildlife corridors used by animals as routes to food, water and habitat areas. Some of these corridors are protected by easements established by the Conservation Commission. The primary corridors that should be protected include from Breakfast Hill along Berry's Brook to Sagamore Creek and the Odiorne State Park, from the Junior High School to the Massacre Marsh, from Parsons Field to Awcomin Marsh, and from West Road through Brown's Pond to Eel Pond. It is the goal of the Conservation Commission to keep these corridors protected to enhance wildlife protection.

H. Open Space

The Town is fortunate to have an abundance of wildlife due to our open space. The latest success can be seen by the growth of flocks of wild turkeys. There are several areas where postings have been made to protect turkeys crossing our roadways.

I. Advantages for dog owners

In addition to benefiting our wildlife, open space has made it easier to accommodate the needs of dogs. While most neighboring towns have restricted dogs from traveling off leashes, we have the advantage of walking our pets on trails in our Town Forest as long as they are under the owners' control. There has been some concern about having dogs on the beaches. Dogs are allowed on the beaches during restricted hours during the summer months as long as they are under the owners' control and the owners' commitment to picking up pet waste. The pet owners are obligated and should encourage others to abide by the local regulations in order to maintain these privileges not provided by other communities.

J. Inventory of Conservation Land.

Now that we have acquired a large amount of open space and conservation land, it is time to present an inventory of these parcels and designate the proper uses, by accomplishing this we will encourage our citizens to use those areas as designated for nature walks, snow shoeing, cross country skiing, and jogging. The inventory is published each year in the Annual Town Report. The Conservation Commission is encouraged to provide guidelines and maps for usage of appropriate conservation trails.

K. Significant Threats to Natural Resources

This section discusses fragmentation, sprawl and threats to water quality, wildlife, wildlife habitat, fisheries and the working landscape.

1. <u>Fragmentation and Sprawl</u>

Fragmentation takes places when large, contiguous parcels of undeveloped land are broken up into smaller or non-contiguous tracts of land for residential or commercial development. This happens hand-in-hand with a sprawling development pattern of conventional subdivisions:

"A typical subdivision in northern New England requires 1 or 2 acre lots. Twenty houses can consume 40 acres, leaving little open space. Placing the same 20 homes on ¼ acre lots and using attractive landscaping and design elements to create privacy consumes only 5 acres, leaving room for 35 acres of open space." (Forest Service, 2005; CEP, 2003).

Fragmentation and sprawl lead to several negative impacts on natural resources, the economy, and society. Fragmentation impacts flood retention as more impervious surfaces such as pavement are added in the course of development. Pavement cannot absorb water and thus water flows in sheets more quickly to streams, rivers, and lakes than it would over forested, wetland, or grassed landscapes which slow down water flows, act as filters and serve as water recharge areas for groundwater (Forest Service, 2005; CEP, 2003; Biodiversity Project, 2005).

Fragmentation disrupts wildlife corridors used by animals as routes to food and water, and severs connections of habitat areas (Forest Service, 2005). The Society for the Protection of New Hampshire Forests observes that "the state's predicted growth of the next twenty years will fragment the large blocks of forests and wetlands that are crucial for providing wildlife habitat and sustaining critical ecological processes (SPNHF, 1999).

Economic impacts of fragmentation and sprawl include greater municipal costs for maintenance of roads, water supply, sewers, school bus routes, and fire and safety services as the population spreads out. As the community requires more services at greater cost, property taxes also rise, forcing landowners to make difficult decisions concerning future land use on their property. (Forest Service, 2005). Automobile use increases with sprawl resulting in greater fossil fuel use, increased traffic congestion, noise, and pollution when work, residences, and goods and services are all in separate locations (Putnam, 1995).

Social impacts of fragmentation and sprawl result in changes to the community. Community culture can change, particularly in small New Hampshire towns where residents once had a close connection to the land through forestry, farming, hunting and fishing, and other recreational activities. The community may suffer as a whole through the loss of recreational activities and a shared natural heritage. Residents who are more widely dispersed often have lower levels of participation in civic affairs and community volunteerism, due to less frequent contact with neighbors and other residents, resulting in an overall loss of social capital for the town: "Each additional ten minutes in daily commuting time cuts involvement in community affairs by 10 percent" (Putnam, 1995).

Areas of Rye such as the development along Lafayette Road have fragmented habitat, reducing land area that provides food, nesting, and breeding habitat, and travel corridors for wildlife. There are still large tracts of land suitable for development in Rye. The questions arise: How are we going to maintain the rural small town concept in the future? How are we going to preserve open space?

For many years the Rye Planning Board has discussed cluster type development. The Retirement Community Development (RCD) zoning was passed in 2010. Twenty-two units, known as White Birch, were constructed on a 10 acre parcel and were clustered in a small area so that the

remaining acreage was retained as forested open space. An RCD proposal for the former Rand Lumber Company site is currently pending before the planning board.

Additionally, in 2010 the town adopted cluster provisions for workforce housing by providing for Conservation Land Developments (CLDs) in the Single Residence and Commercial Districts. RCDs and CLDs are good examples of how we can save open land while providing for needed retirement and workforce housing.

Fragmentation and Sprawl: Impacts	Proposed Solutions for Rye
Need for Cluster and/or Pocket neighborhood type zoning in order to protect our Open Space. Increases in impervious surface/ decreased flood retention/ faster delivery of pollutants to streams and wetlands	Changes in the zoning and land development Regulations. Allow narrower streets in subdivisions to reduce impervious surface. Require on-site infiltration and vegetated buffers for streams and wetlands. Require low impact development strategies for drainage plans.
Greater automobile emissions, congestion, greater infrastructure costs for isolated subdivisions at the end of long cul-de-sacs	Provide for walkable or bikeable subdivisions. Require two points of connectivity in new subdivisions to existing street networks.
Fragmentation of forests restrictive to species range requirements	Require contiguous areas of wetland/other habitat be designated at beginning of design phase for conservation subdivision. Require developers to protect trees from impacts of construction activities.
Roads, etc disrupt wildlife corridors	Provide tunnels, wider culverts, or other safe crossings for wildlife where roads fragment habitat

4.0 IMPORTANCE OF RYE'S WATER SUPPLY

Since Rye is located in Rockingham County, one of the fastest growing population areas in New Hampshire, our third most important natural resource is our water supply. Approximately 75% of the town is supplied by Rye Water District by a system of wells located near Garland Road.

A. Ground Water Resources in Rye

1. Groundwater is present in both bedrock and in the unconsolidated materials that overlie bedrock (overburden). Rye is fortunate to have valuable groundwater deposits in both the overburden and bedrock. Glacially derived stratified drift deposits, primarily made up of sand and gravel make up the valuable overburden deposits. The Stratified Drift Aquifers Map included in the Master Plan shows the extent of these aquifers. The dark blue indicates areas where saturated sand and gravel has the highest transmissivity or the greatest ability to transmit groundwater to wells.

The Rye Formation, which underlies much of Rye, contains fractures, which transmit water to wells. This formation has zones of fracturing that make it transmissive and valuable as a water supply source.

The Rye Water District has sited wells in the most transmissive zone of stratified drift deposits and within the fractured Rye Formation bedrock. Both of these water systems are located on Garland Road.

2. Groundwater and Surface Water – A Single Resource

Although often thought of as distinct systems, groundwater and surface water, especially in coastal New Hampshire are closely linked. A lead in to a recent US Geological Society report states " As the Nation's concerns over water resources and the environment increase, the importance of considering ground water and surface water as a single resource has become increasingly evident". (Winter, et al., 1998). Groundwater will discharge to surface streams, wetlands and ponds and surface water often provides recharge to underlying groundwater. Therefore human activity can inadvertently affect both the quality and the quantity of both resources.

3. Ground Water Quality

Contaminants in groundwater pose a number of human health concerns. Chronic bioaccumulation of toxins impairs drinking water and affects wildlife species by degrading the overall water quality required for ecosystem function. Increased turbidity in freshwater streams for example results from erosion and has a negative impact on aquatic life. Fish and shellfish contamination not only affects human health, but also has an economic impact on the fisheries economy and travel/tourism industry.

New Hampshire groundwater quality is threatened by naturally occurring contaminants such as fluoride, arsenic, mineral radioactivity and radon gas, and contamination from releases of petroleum and volatile organic compounds (VOCs) from commercial and industrial activities. VOCs and other petroleum related substances are the most frequently detected substances. The sources of these petroleum related contaminants are petroleum storage tanks, accidental spills of petroleum, and the land disposal of wastes (NHDES 1996).
(MTBE has been eliminated from gasoline, some still remains but it is not as serious a problem as in years past).

Radon in groundwater is prevalent in the Northeastern United States and New England to a greater extent than is found in other parts of the country (Zapecza and Szabo, 1988). This is largely due to the type of bedrock in the region. NHDES estimates that up to 5 percent of the bedrock wells in New Hampshire have significant concentrations of radionuclides such as uranium, radium-222, and radium-228. Sodium and chloride due to road salt usage is also a contaminant of concern. According to one study, "contamination from road-salt storage piles and facilities and spreading of salts on roadways was the cause of 79 percent of the contaminated wells in New Hampshire" (Morrisey, 1998).

Septic systems that have failed or are not working properly can introduce excess nitrogen and bacteria into groundwater. Other constituents in septic effluent are not treated by infiltration and assimilation in the subsurface as well. New threats to groundwater and surface water include pharmaceuticals and personal care products that pass to groundwater from human waste through septic systems and from wastewater discharge. Household and landscape chemicals if not properly used or applied can also become incorporated into runoff and groundwater.

Threats to Groundwater Resources	**Proposed Solutions for Rye**
Petroleum related contaminants, snow removal chemicals such as road salt, accidental spills of chemicals related to industrial uses Pharmaceuticals and personal care products and excess nitrogen can also be introduced through waste discharge. Lawn irrigation and landscape water use places demands on water resources during the time of year when water levels are typically lowest.	An Aquifer Protection Ordinance has been developed and adopted by the Planning Board which limits land use and requires protective measures and design review. Regular updates to the Ordinance should be incorporated to keep it current with new understanding of impacts to groundwater. Promote landscape and field management practices that optimize and reduce landscaping chemicals. Promote on-site management of stormwater. Promote the use of slow release nitrogen fertilizer. Promote these changes through outreach to landscape professionals. Residents and commercial property owners and ordinances if necessary. Provide outreach and education to landscape professionals, residents and commercial property owners on optimizing water use, using low impact irrigation techniques, and using water based on soil moisture and plant needs. Follow recommendations of Berry's Brook Watershed Management Plan and other watershed plans developed for Rye watersheds. Review and update these plans as needed. Restricting certain uses in the Aquifer Protection Zone and requiring appropriate practices for handling and storing waste and snow removal chemicals. Follow recommendations of Berry's Brook Watershed Management Plan. Additional promotion for the annual Hazard Waste Collection Drive.

Surface Water

Water resources are plentiful and diverse in Rye, but are nevertheless prone to threats from a variety of sources. Water quality is threatened by pollution from point sources (pollution from an identifiable point of discharge) such as septic systems, or run-off from parking lots and from non-point sources (pollution from an unidentifiable point of discharge) such as atmospheric deposition of acid rain and mercury. Waters are classified as "impaired" if they are of unsuitable quality for swimming, maintaining healthy aquatic biota, and (or) have a fish consumption advisory posted (Flanagan et al., 1998).

Threats to water quality include a number of contaminants, such as metals (including mercury), PCBs, dioxin, phosphates and nitrates from agricultural, commercial and residential use of fertilizers and pesticides and industrial waste, as well as physical and biological processes including siltation and erosion, organic enrichment resulting in low dissolved oxygen, flow alterations, and habitat alterations. According to The Department of Environmental Services (DES), metals, PCBs (polychlorinated biphenyls), and bacteria are the leading threats to water quality in freshwater rivers and streams.

Other Threats to Surface Water

In freshwater lakes and ponds, major threats include low pH values due to acid rain as well as the state's natural low alkalinity levels caused by granite bedrock. Excessive algal growth, noxious aquatic plants, and bacteria also present threats to surface water. The New England Coastal basins are underlain by large amounts of bedrock, which has little to no buffering capacity. The result is that surface waters are susceptible to acidification from atmospheric deposition, introduction of exotic species, municipal and industrial point and non-point pollution sources.

Tidal, Coastal, and Open Waters

Tidal waters, coastal shoreline waters, and open ocean waters have yet another set of contaminants which pose significant threats to water quality. PCBs, bacteria, and metals are the primary threats to estuaries; PCBs are the primary threats to coastal waters and open ocean waters. Known sources include sewer cross connections, and combined sewer overflows.

Salt Marshes

Historically, salt marshes were harvested for salt marsh hay. A healthy salt marsh appears as a flat, low meadow of dense salt tolerant grasses. Tidal flooding distributes water through a system of creeks in healthy marshes. In the state of New Hampshire, there are about 6,200 acres of salt marsh. Due to its coastal location, salt marshes are an important and prominent ecosystem in the Town of Rye. Salt marshes are highly productive ecosystems that rely on a delicate balance between marine and terrestrial environments. Marshes provide scenic views, open space and habitats for many types of wildlife including fish and birds such as snowy egrets and great blue herons. Marshes also provide water filtration and areas for flood retention and flood control (NRCS, 2005).

Threats to salt marshes include changes to natural hydrology, pollution, coastal development, fill/marsh elevations, and invasive plant species. During the early 1900s roads and railroads were constructed and severed the connection between salt marshes and the ocean, these areas were highly productive ecosystems. Parts of the marsh were no longer connected to the ocean. This division reduced or eliminated tidal flooding, which disrupted natural flooding regimes and altered soil and water chemistry, resulting in changes to natural plant and animal communities, including the introduction of invasive species such as phragmiteses and purple loosestrife (DES, 2004). Other threats to salt marshes include failed attempts to provide flow such as the installation of culverts, which were too small (NRCS, 2005). Mosquito control efforts have also sometimes resulted in negative impacts to salt marshes through poorly designed ditches or other attempts to drain marshes (NRCS, 2005).

Many communities now recognize these negative effects and are now working actively to restore their salt marshes. Restoration efforts are discussed at length in sections to follow and the appendix to this chapter includes a list of current salt marsh restoration projects in the region.

Threats to Water Quality: Impacts	Proposed Solutions for Rye
Nonpoint pollution adds nitrates, contaminants to surface water and wetlands	Buffer rivers, lakes, and wetlands with vegetated buffers.
Mercury contamination may have human health impacts, negative impacts to wildlife	Educate residents about fish consumption advisories and impacts of acid rain deposition, support recycling of mercury wastes, follow state plan for mercury reduction, Berry's Brook Watershed Management Plan
Lead contamination	Educate anglers about New Hampshire's prohibition lead sinkers and jigs, and safely dispose of certain lead sinkers and jigs at NH Fish and Game offices
Lawn chemicals add contaminants and nitrates to wetlands through runoff	Consider restrictions on pesticide/fertilizer use in new subdivisions that abut wetlands

Increases in Impervious surface and Water Quality

Impervious surfaces impede the infiltration of water into the soil. Examples of impervious surfaces include roads, parking lots, buildings, concrete and severely compacted soils. Such surfaces are also sometimes referred to as impermeable (New Hampshire Estuaries Project, 2004).

The increase of impervious surfaces through development affects water resources in several ways. Impervious surfaces combined with urban drainage systems such as curbs and gutters and storm drain pipes can alter the natural hydrology in a watershed by increasing the volume of stormwater and reducing groundwater recharge. Impervious surfaces can also result in loss of aquatic habitat, loss of biological diversity, and an overall decrease in water quality due to the accelerated delivery of pollutants into rivers, lakes, and estuaries (NHEP, 2004).

Recently, scientists have reported that levels of impervious surface in excess of ten percent in a watershed can affect water quality. "When the percentage of impermeable surfaces in a

watershed is ten percent or less, streams typically retain good water quality and stable channels. When the proportion is between ten to twenty-five percent, stream fed flows cause noticeable erosion" (Perkins, 2004). More than twenty-five percent impermeable surface can lead to severe physical and ecological damage to streams in a watershed (Perkins, 2004).

Pollutants in runoff include suspended carcinogens known as polycyclic aromatic hydrocarbons, which can leach from asphalt-based and coal tar-based sealants. Other pollutants often found in runoff include pesticides, nitrates, phosphates, and salt for de-icing roads (Perkins, 2004).

Increases in impervious surface may result in less infiltration of rainwater into the soil, increasing flooding, streambed erosion, and sedimentation (DESFS, 2004). Runoff may also change the temperature of bodies of water as it may be warmer, and may contain pollutants including household chemicals, metals, fertilizers, pesticides, oil and grease, and pathogens. Loss of vegetation buffers due to development or erosion can also alter the temperature of water bodies to a level at which species cannot persist (DEFS, 2004), (*DES fast sheet)

Impervious surfaces represent a threat not only to the green infrastructure of streams and water recharge areas, but also to the social and built infrastructure components of municipal services. In other words, reducing impervious surface not only helps to improve water quality, it may also result in lower municipal costs for road maintenance and clearing and lower development costs. A 100-foot reduction in road length will result in a savings of about $15,000. This figure includes savings from reduced pavement, curb and gutter, and stormwater management structures (Center for Watershed Protection, 1998). Well-planned street layouts will reduce impervious surface and help alleviate traffic congestion. The goal is to protect conservation areas, and create a street system that optimizes the ability of town fire and rescue officials to respond to emergencies in a timely and efficient fashion.

Threats from Impervious Surfaces	Proposed Solutions for Rye
Flooding, reduced suitability of land for water recharge	Conduct a review of Rye's ordinances and regulations based on Better Site Design checklist. Require on-site infiltration. Amend building codes to require drip beds, rain barrels and other infiltration devices for structures.
Delivery of pollutants to water bodies, wetlands, traveling across paved areas	Buffer water bodies, reduce amounts of impervious surface through use of narrower roads in subdivisions.
Increased municipal costs, poorly designed road networks that result in congestion and higher municipal costs	Limit lengths of cul-de sacs, roads in new subdivisions. Restrict development to areas adjacent to existing development.
Pavement	Allow narrower street widths.

Rye is a town with a large deer population. Collision between deer and motor vehicles seems to be an increasing event, resulting in injury or death to the deer, damage to vehicles and possible injury to the motorists. To decrease this occurrence we should recommend increased signage in known deer crossing areas.

Human Activity

Everyday activities associated with development can have negative effects on wildlife. Lighting can affect the behavior and biological rhythms of species that are guided by cycles of light and dark. Domestic pets such as cats may become predators to ground-nesting birds. Household trash may attract certain species and allow them to thrive (DESFS, 2004) and may create nuisance conditions or human/wildlife conflicts.

Threats to Wildlife	Proposed Solutions for Rye
Fragmentation of habitat	Protect green corridors through purchase of fee title or easements, follow State Wildlife Conservation Plan and mapping to designate protected areas
Lighting	Require dark-sky standards for new developments or site plans, fully shield or full cutoff fixtures.
Private landowner education	Educate landowners about pet predation, disposal of household trash, and household lighting. Educate landowners about voluntary federal incentive programs to protect habitat on private land
Invasive species	Monitor invasive species in new development and near critical areas such as wetlands, salt marshes, remove invaders such as Phragmites to slow proliferation. Educate boaters on removing aquatic species from boat hulls.
Nuisance wild animals: geese, coyotes, deer	Educate landowners about nuisance animals through Fish and Game resources. Consider possible options for control of animals. Learn seasonal hunting options and restrictions. Coyotes have no closed season and can be hunted at night during certain times of the year.

Biodiversity

Wildlife losses can be measured not only in terms of individual species, but also in terms of an overall loss in biodiversity. Biodiversity is critical to ecosystem function, or green infrastructure, due to the interdependent relationships between animal and plant species. Biodiversity is also important to sustaining the built and social infrastructures, due to the importance of ecosystem function to science, economics, energy, and health.

With increased development pressures, the environmental, economic, and social utility provided by New Hampshire's water resources, wetlands, forests, fields, and wildlife is severely compromised. Although ecosystems are made up of dynamic, adaptive processes that can respond to many stressors, the recent impacts of growth and the loss of important resources has resulted in the loss of species and the degradation and loss of water resources, forests, wetlands, salt marshland, and farmlands.

The Town may wish to utilize new information available from the state Fish and Game Department concerning the state wildlife habitat protection plan. This plan will contain individual information for each town in the state on wildlife habitat as well as mapping of wildlife habitat areas. The Town could use this mapping to develop plans for management of town owned lands and to identify areas in the town worthy of protection. The maps included in the state plan will be helpful in this regard. The Wildlife Habitat Map, included as part of the map set with this chapter, shows 10 different types of areas of habitat types important for a particular species. The list of species for each type is included in the appendix with this map.

If the Town decides to utilize these maps, several useful resources are available to help identify areas of wildlife habitat as well as to document the occurrence of species. One particularly helpful resource is the guide "Identifying and Protecting New Hampshire's Significant Wildlife Habitat," (2001) which is available online but also is included with the initial data and maps distributed to every town from the state Fish and Game Department.

4.0 THREATS TO THE WORKING LANDSCAPE

Many important environmental services are provided by the working landscape, including water filtration by wetlands and marshlands, flood control, water recharge areas, wildlife habitat, improved air quality, erosion and sediment loss control, and moderation of climate change, as large fields and forests serve as carbon sinks, where carbon is sequestered. Rye has a long history and cultural tradition of stewardship of the working landscape. In order to sustain the many economic, cultural, and environmental benefits of the working landscape, citizens, planners, and developers must work together to ensure that growth is planned so as to minimize the detrimental effects of development on the working landscape, to protect the many economic, environmental, and social benefits the working landscape provides.

Threats to the Working Landscape	Proposed Solutions for Rye
Loss of farming, fishing and hunting as part of regional character and traditional ways of life. Loss of important environmental services such as water filtration, erosion control, and moderation of climate change.	Protect areas used as hunting grounds, scenic viewsheds, and farms from development through restrictive zoning, cooperative farms, or outright purchase. Encourage outdoor recreation on Rye public lands and on privately owned parcels with legal access. Educate private landowners on practices to protect waterways and provide wildlife habitat.

Climate Change

Climate Change impacts could affect quality of life in New Hampshire. Alterations to our climate will result in adaptive changes or decline in certain sectors of the regional economy, including winter tourism, agriculture, maple syrup production, coastal real estate values due to sea level rise and increase in storm intensity, and health costs associated with respiratory health and heat related illnesses. With respect to local hazard mitigation planning, it is important to consider the potential future impacts of climate change including sea level rise, flooding, coastal

erosion, increased intensity and frequency of storms, and the effects of changes in temperature and precipitation.

Our state's economy is linked to both summer and winter recreational activities based on its natural resources. If these suffer, the economy will also suffer. Increased frequency and severity of damaging storm events and droughts could cause financial and personal hardships. Decreased quality and production of forestry and agriculture products could also have a significant impact on the economy and quality of life.

5.0 NATURAL CONDITIONS AFFECTING DEVELOPMENT

5.1 Topography

Rye's land is gently sloping and ranges in elevation from sea level to approximately 150 feet in elevation at Breakfast Hill in the southwest corner of the town. The town is traversed from northeast to southwest by a low ridge, and five smaller ridges run from the diagonal ridge eastward to the ocean. In between the ridges are tidal and freshwater marshes, thus the roadway development in the town have followed the ridge lines. The predominant slope category in Rye is 3 to 8 percent, and in general, topography per se, does not constrain the overall development of the town.

5.2 Geology and Soils

The major conditions which limit development are:

1. Tidal marshes.
2. Freshwater wetlands.

The soils suitable for development exist in relatively narrow bands along the ridges occupied by Washington Road, Wallis Road, Central Road, Locke Road, Grove Road, Cable Road and South Road.

The Rye Zoning Ordinance establishes a Wetlands Conservation District, in cooperation with NH DES, which essentially prohibits building construction in the tidal marshes, freshwater marshes, streams and ponds. The zoning ordinance also includes a Wetlands Buffer regulation, which provides further protection of wetlands by prohibiting most uses of land within 100 feet of tidal marshes, freshwater marshes, ponds, and perennial streams.

Rye's Land Development Regulations and the Building Code require that all septic systems receive the approval of the New Hampshire Water Supply and Pollution Control Division. Special criteria related to the depth to bedrock, seasonal high water table, land slope and soil percolation rate are also incorporated into the land development and building regulations. Additionally, The Land Development Regulations include provisions for high intensity soils mapping standards.

Impact of Septic System Expansion on Natural Drainage

The negative environmental impact on natural drainage caused by septic system expansion/replacement in areas of shallow to bedrock soil is an increasing problem in the town. The mounding of the soil over the septic designs causes excessive runoff to the adjacent roads, wetlands, and properties. Often, these septic systems are surrounded by lawn irrigation systems adding chemical deposits to the runoff. The lawn chemical runoff poses a threat to natural habitats and wildlife. There are several examples of this problem in the Fairhill Estate section of Rye. In fact, this has caused drainage problems adjacent to these "mounded" septic systems during particularly wet periods.

Potential solutions to this situation have prompted the town to design complex drainage systems including catch basins. The cleaning of the catch basins has become a time consuming and costly burden to the town.

A better approach might be to include site-specific natural drainage planning when septic approvals are considered. This proactive approach could consider landscaping requirements using swales, rocks, shrubs, to allow lot specific drainage, and, therefore avoiding interrupting old natural drainage patterns. This approach would proactively prevent standing water on the roads, which leads to pavement deterioration.

It should also be noted that in the fragile ecological environment of highly developed areas in Rye, blasting for further development should be carefully reviewed and quite possibly prohibited; such blasting interrupts the water table creating even more complicated drainage issues.

5.3 Hydrology

Rye is part of two major drainage watersheds, the Piscataqua River Watersheds and the Coastal Watershed. The ridge which traverses Rye diagonally from Little Harbor to Breakfast Hill forms the divide between the two watersheds. Within these two watersheds are six smaller drainage watersheds. Water from the land surface flows towards the streams, wetlands and rivers located in the lowest areas in each watershed area.

There is a large area of stratified drift aquifer in Rye, which contains several smaller areas of high transmissivity, as shown on the Stratified Drift Aquifers Map. Transmissivity is a measure that quantifies the ability of an aquifer to transmit water, measured in feet squared per day. The greatest transmissivity of this aquifer area is found in two areas, one of which generally is found beneath the area along Washington Road to the intersection of West Road. The other area is near the intersection of Washington Road and Grove Road.

The Information about the groundwater resources in Rye has been enhanced by the Fracture Trace Analysis done by the Rye Water District. Groundwater within the two major watersheds is interconnected by bedrock fractures so that water is exchanged between the two areas. Groundwater from wells completed in the stratified drift and fractured bedrock provides much of the town's drinking water supply which is located in west Rye off Garland Road.

The primary relationship between hydrology and development concerns water quality. Recent water quality evaluations have revealed bacterial contamination in the Parson's Creek watershed. Restoration of water quality in this area is under investigation and should be continued to identify and clean up these bacteria source areas. Additional testing and evaluation should be conducted in Rye's remaining watershed areas as much development and change has occurred since previous testing in the 1978 to 1990 time frame.

In 2008, the town of Rye adopted an Aquifer Protection Overlay district within the boundaries of the Stratified Drift Aquifer. This limits land use and prevents development and land use practices that would contaminate or reduce the recharge to the identified aquifers and required a hydrologic study for developments meeting a certain size criteria. This ordinance should be periodically reviewed and updated to assure that it is current with respect to town needs and hydrologic understanding.

IN ADDITION TO THIS ORDINANCE, THE TOWN SHOULD

- Promote low impact development to protect all water resources in the town.
- Continue to promote best management practices for municipal, commercial and residential land use and provide outreach and education to constituents on threats to surface water and groundwater quality and resources.

- Continue to work closely with the Rye Water District on their groundwater management activities.
- Seek to permanently protect land through land purchase or conservation easement to protect the groundwater resource especially in the vicinity of water supply wells.

5.4 Floodplains

The floodplains of Rye have been mapped by the National Flood Insurance Program on Flood Insurance Rate Maps (FIRM). The FIRMs were updated and approved in spring of 2005. New FEMA maps are anticipated for adoption in 2015. All towns participating in the flood insurance program must reference the updated maps in their zoning ordinance. Based on the new maps, the Town is expected to strengthen its Floodplain Ordinance.

Zone A2: Areas of 100-year flood.

Zone AO: Areas of 100 year shallow flooding.

Zone V: Areas of 100-year coastal flood with velocity (wave action).

With the exception of Locke's Neck, the area protected by the Wallis Sands seawall, Fairhill Manor and parts of Odiorne Point, most of Rye's developed coastline (including approximately half of the densely developed Jenness Beach area) is located in Flood Hazard Zones V, A2, or AO. Inland, Flood Hazard Zone A2 extends to the borders of all of Rye's salt marshes, Witch Creek, most of Berry's Brook and all three of the major ponds.

Inland, the undeveloped land in Rye that is in the 100-year flood zones depicted by the FIRM is land that is also classified as wetlands and thereby precluded from development by the Wetlands Conservation District. However, along the coast, sizable portions of the flood hazard zones are developed. The requirements of the Flood Insurance Program, which are effected through the Town of Rye's Floodplain Development and Building Ordinance, require that new or substantially improved residential construction have the first floor located above the base flood elevation and that new or substantially improved nonresidential structures located below the base flood elevation be flood proofed. Further flood plain regulation is imposed by the New Hampshire Water Pollution Supply and Pollution Control Division of the Department of Environmental Services further regulates the flood plain: NHDES will not approve a new on-site septic system located in a 50-year floodplain.

Figure NR-1

Freshwater Wetland Mitigation Inventory for Nineteen Coastal Communities, by West Environmental and Carex Ecosystem Services, in cooperation w/ Doucet Survey, Inc. 2003.

Site ID	Name	Location	**Mitigation Proposed (Size in acres)**	**Site Summary** *(note: NHNHI-New Hampshire Natural Heritage Inventory)*
RE2	Berry's Brook	Area west of US 1	Restoration: .5 acres / Preservation: 150 acres	Large wetland with a degraded Atlantic white cedar community. Site provides linkages to other conservation lands.
RE3	Forested Swamp	East of Brackett Rd. between Washington Rd and Wallis Rd.	Restoration: .5 acres Preservation: 14 acres	This wetland links the adjacent estuary with upland habitat. Much of the proposed upland buffer has been developed. An area of old cottages has been developed. An area of old cottages could be restored either as wetland or as an upland "island" habitat for wildlife value. Includes NHNHI element(s).
RE4	Unnamed brook	West of Brackett Rd between Washington Rd. and Wallis Rd.	Preservation: 30 acres	Southern side fragmented by a long driveway crossing. Tidal marsh appears more extensive than shown on NWI map. Much of the upland buffer is already developed/fragmented. Important wetland buffer, the estuary, and NHNHI element(s). Connects to conservation lands on eastern side of Brackett Rd.
RE5	Berry's Brook	East of Sagamore Rd., north of Clark Rd.	Restoration: .2 acres Preservation: 40 acres	Most of potential upland buffer along Sagamore Rd. is already developed. Highly valuable wetland includes a large area of floodplain associated with Berry's Brook and reported NHNHI element. Significant buffer area remains in eastern portion. Culvert replacement recommended to facilitate wildlife movement under Sagamore Rd.
RE6	Witch Creek	Inside New Castle Rd, Sagamore Rd., and Pioneer Rd.	Restoration: .5 acres Preservation: 15 acres	Wetlands with reported NHNHI element(s). Site is adjacent to golf course, If NHNHI elements are confirmed, there could be restoration of wetlands impacted by golf course runoff. Preservation or restoration would be difficult as the golf course would be affected.
RE8	Partially filled quarry and pond	New Castle Rd.	Restoration: 10 acres	This is a partially filled rock quarry. This potentially high value wetland links adjacent conservation lands and Sagamore Creek. Site is in an area of high development pressure adjacent to golf course and views of the estuary. Fill is old and includes some trash that may involve contamination issues. Appropriate measures may be needed to prevent Phragmites invasion.

The Town may wish to utilize this information to supplement its current work in protecting Rye's wetlands.

7.0 COASTAL WILDLIFE HABITAT AND SPECIES

Coastal species play an important role in the coastal ecosystem, provide recreational harvesting activities, and serve as an important food sources to many residents.

7.1 Shellfish

The New Hampshire Department of Environmental Services (DES) Watershed Management Bureau is responsible for monitoring coastal shellfish growing waters. The shellfish program evaluates the sanitary quality of all coastal shellfish growing waters in the state and ensures that these evaluations are kept current through periodic re-evaluations. The program identifies pollution sources and other factors that may render shellfish resources unfit for human consumption. Agents in the program work with local officials, state agencies, environmental organizations, and members of the public to eliminate pollution sources and inform and educate the public about the quality of the state's shellfish resources and potential health risks associated with shellfish. The ambient monitoring program collects water samples from over 75 locations in the tidal waters of the state. The Red Tide monitoring program collects weekly samples of blue mussels from two sites during April through October to check the levels of Paralytic Shellfish Poison toxin in shellfish.

Three state agencies are responsible for the overall management of shellfish sanitation, harvesting, and resource health. DES is responsible for monitoring. Fish and Game is responsible for issuing harvesting licenses, managing resources, and enforcing the decisions of the DES to open or close a shellfish harvesting area. The Department of Health and Human Services regulates aspects of the commercial shellfish industry.

Rye Harbor is one of the locations where DES collects water quality samples for analysis. This information is used to make decisions concerning open/closed areas and to track changes in water quality over time.

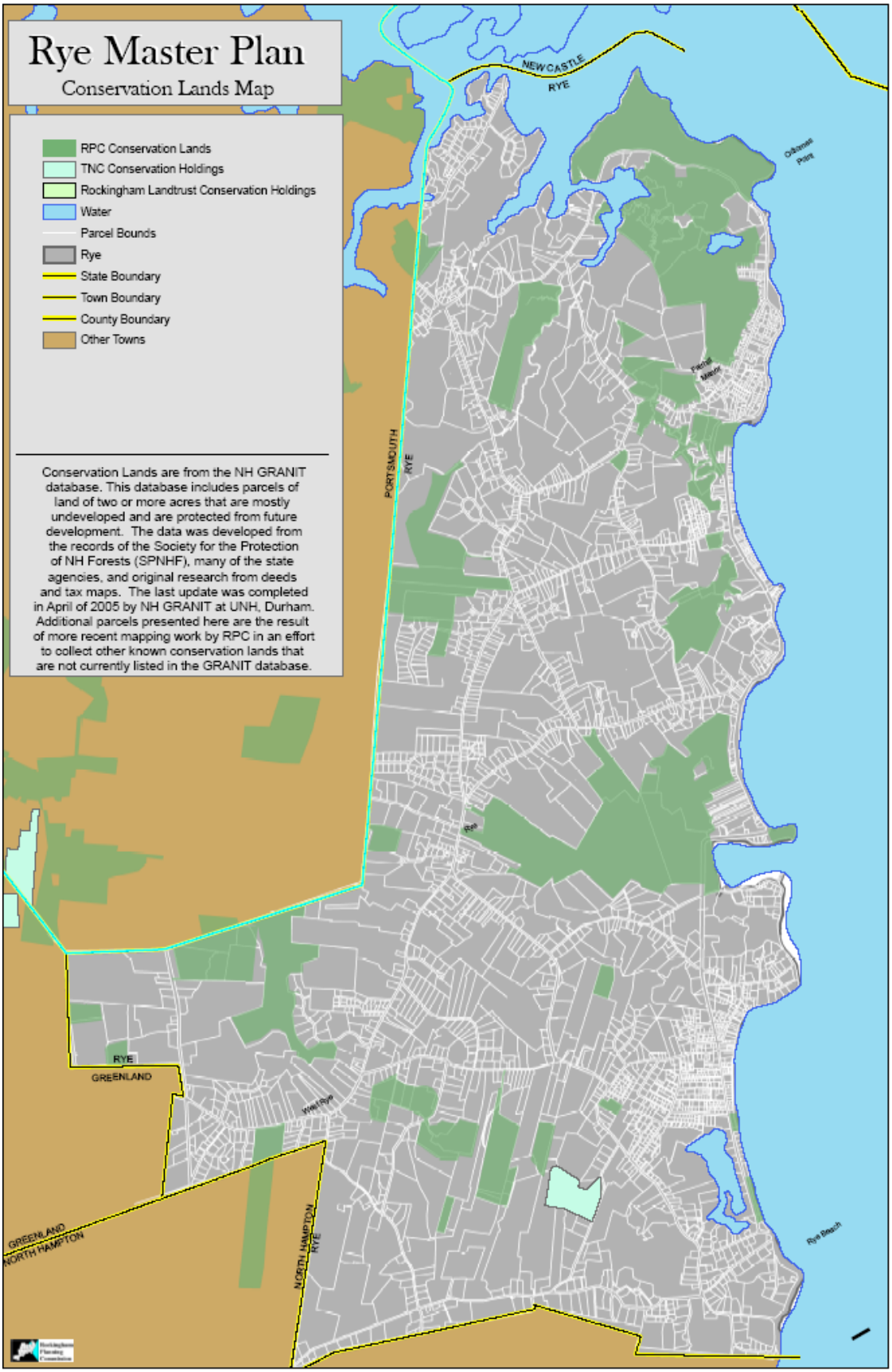
Next Steps

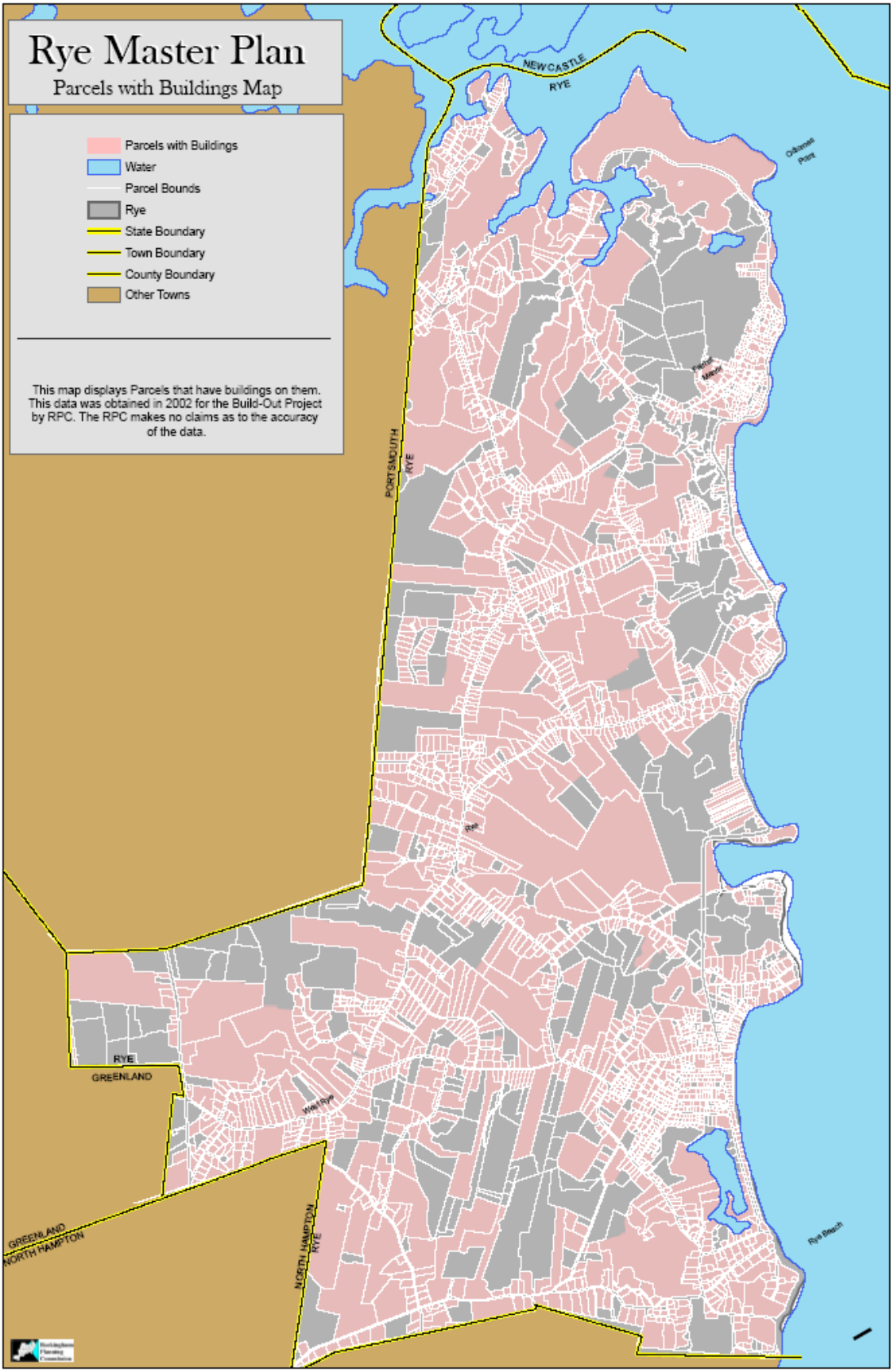
Based on the above analysis and the visioning session, the following matrix was developed. Town boards and citizens can use this matrix to develop a set of goals, strategies, and actions, which can be associated with a projected timeline for action and a core group of responsible parties: those who will lead efforts to implement specific action items.

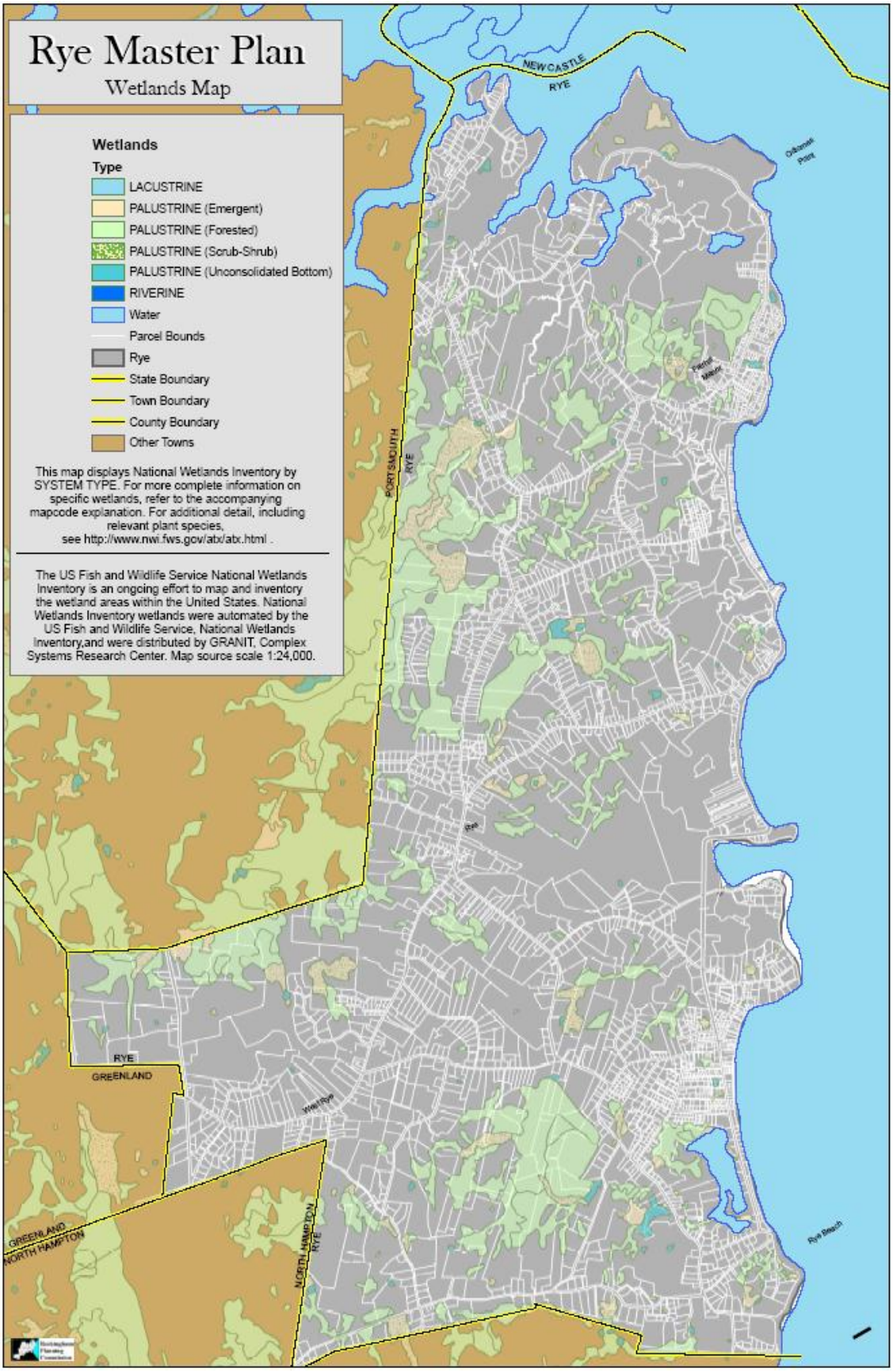
A matrix worksheet based on the comments from the visioning session and the major sections of this chapter with suggested categories is included on the following page. This matrix can serve as a guide for the town's own matrix. A number of resources are available to assist the Town in developing strategies and specific actions to achieve their chosen goals, including the Rockingham Planning Commission, UNH Cooperative Extension, and the Handbook for New Hampshire's Municipal Conservation Commissions (Swope, 2004).

Figure NR-2 Goals, Strategies and Actions

	Strategy	Action Item	Timeline	Responsible Party
COMMUNITY VISIONING MEETING: To hold a meeting where citizens and Board members can voice concerns about natural resources.	To identify problem areas with our Natural Resources	To formulate solutions	One year	Town Citizens and Planning Board
FORESTS: Manage **forests** for conservation and commercial use based on scientific data. Avoid fragmentation.	Use resource inventories and forest mapping and studies	Identify green corridors for protection through purchase or zoning. Protect trees from impacts of development.	Ongoing	Conservation Commission, Planning Board
WETLANDS: Protect wetlands from non-point pollution.	Utilize wetland mapping and required vegetated buffers	In 2012 the Zoning Ordinance was changed to better protect the wetlands and the wetland buffer.	Ongoing	Planning Board, Conservation Commission
OPEN SPACE/CONSERVATION Lands: Acquire and manage lands for conservation	Encourage landowners to donate or sell easements, encourage conservation subdivisions.	Outreach to landowners by Land Trust and Conservation Commission. Warrant Articles for more funds.	Ongoing	Conservation Commission
WILDLIFE CORRIDORS: Acquire contiguous parcels to build wildlife corridors.	Utilize fish and game mapping and data and town local knowledge	Purchase of fee title or easements, natural resources inventory	Ongoing	Conservation Commission
PATHS/SIDEWALKS: Connect areas of town for access, recreation.	Seek transportation enhancement funding for small projects where appropriate	Identify appropriate areas for connections and recreation consider funding mechanisms	Ongoing	Selectmen. Planning Board
WATER QUALITY: Utilize new and existing information on aquifers, water supply, waste discharge and water usage to plan for the future land use.	Review Aquifer protection ordinance. Educate landowners about proper chemical disposal.	Follow current studies on aquifers, water demand and water flow models from USGS NH and DES	Ongoing	Rye Water District, Hydrologist, Planning Board, Selectmen
INVENTORY OF CONSERVATION LAND: to create something for the public to view all conservation lands.	To make the public aware of the resources for Open Spaces.	Mapping	One year	Conservation Commission
PREPARE FOR OCEAN FRONT STORMS: With threat of rising tides and more ocean front storms the community needs additional protection.	Develop ways to help protect the Town and its citizens along the Seacoast.	Stabilizing the Shale piles	One year	DPW, State of NH, Building Inspector
NEED FOR CLUSTER AND/OR POCKET NEIGHBORHOOD TYPE ZONING: In order to protect our Open Space	In order to protect our Open Spaces we need to update our zoning so that homes are built closer together and open space is preserved.	Zoning Ordinance and Land Development Changes	One year	Planning Board


Rye Master Plan
Conservation Lands Map
RPC Conservation Lands
TNC Conservation Holdings
Rockingham Landtrust Conservation Holdings
Water
Parcel Bounds
Rye
State Boundary
Town Boundary
County Boundary
Other Towns
Conservation Lands are from the NH GRANIT database. This database includes parcels of land of two or more acres that are mostly undeveloped and are protected from future development. The data was developed from the records of the Society for the Protection of NH Forests (SPNHF), many of the state agencies, and original research from deeds and tax maps. The last update was completed in April of 2005 by NH GRANIT at UNH, Durham. Additional parcels presented here are the result of more recent mapping work by RPC in an effort to collect other known conservation lands that are not currently listed in the GRANIT database.
NEWCASTLE
RYE
PORTSMOUTH
RYE
RYE
GREENLAND
West Rye
GREENLAND
NORTH HAMPTON
NORTH HAMPTON
RYE
Rye Beach


Rye Master Plan
Parcels with Buildings Map
Parcels with Buildings
Water
Parcel Bounds
Rye
State Boundary
Town Boundary
County Boundary
Other Towns
This map displays Parcels that have buildings on them. This data was obtained in 2002 for the Build-Out Project by RPC. The RPC makes no claims as to the accuracy of the data.
NEWCASTLE
RYE
PORTSMOUTH
RYE
RYE
GREENLAND
GREENLAND
NORTH HAMPTON
NORTH HAMPTON
RYE


Rye Master Plan
Wetlands Map
Wetlands
Type
LACUSTRINE
PALUSTRINE (Emergent)
PALUSTRINE (Forested)
PALUSTRINE (Scrub-Shrub)
PALUSTRINE (Unconsolidated Bottom)
RIVERINE
Water
Parcel Bounds
Rye
State Boundary
Town Boundary
County Boundary
Other Towns
This map displays National Wetlands Inventory by SYSTEM TYPE. For more complete information on specific wetlands, refer to the accompanying mapcode explanation. For additional detail, including relevant plant species, see http://www.nwi.fws.gov/abx/abx.html .
The US Fish and Wildlife Service National Wetlands Inventory is an ongoing effort to map and inventory the wetland areas within the United States. National Wetlands Inventory wetlands were automated by the US Fish and Wildlife Service, National Wetlands Inventory,and were distributed by GRANIT, Complex Systems Research Center. Map source scale 1:24,000.
NEWCASTLE
RYE
PORTSMOUTH
RYE
RYE
GREENLAND
GREENLAND
NORTH HAMPTON
NORTH HAMPTON
RYE
Rye Beach