G. Watersheds

The Town of Raymond lies within two major watersheds; the Lamprey River and the Exeter River. Watersheds are natural drainage basins that allow water to flow to the lowest point within the basin, in this case the Great Bay Estuary. A watershed consists of the land area that contributes water to a body of water or watercourse; be it a stream, river or lake. Today there is considerable development pressure on watersheds, and a concerted effort to protect the rivers, aquifers, and other natural resources for future generations should be a top priority for the Town of Raymond. Previously, the Town's 1993 *Water Resource Management and Protection Plan* delineated thirteen watersheds which lie within Raymond's municipal boundaries. These watersheds however, have been combined and updated for this master plan based upon the latest United States Geological Survey Sparrow watershed data as well as the NH DES hydrographic data and are identified in Table 72.

Table 72
Watersheds
Town of Raymond, NH

Lamprey River Basin	Area in Raymond	Percent
Flint Hill	2,607	14%
Pawtuckaway River	796	4%
Dudley Brook	2,743	14%
Robinson Hill	705	4%
Upper Lamprey River	180	1%
North Branch River	503	3%
Onway Lake	1,691	9%
Middle Lamprey River	3,053	16%
SubTotal	12,284	
Exeter River Basin		
Fordway Brook	4,483	24%
Little Rattlesnake Hill	1,460	8%
Exeter River	631	3%
Wason Brook	91	0%
SubTotal	6,665	
Total	18,943	100%

Source: Water Resources Management Plan, Town of Raymond,

The Exeter River

The Exeter River begins in the Town of Chester, and flows east and north to the Town of Exeter where it becomes tidal. The name changes to the Squamscott River, before emptying into the Great Bay Estuary. Its drainage basin encompasses an area of 126 square miles. The upper 33+ miles of the river, from it's headwaters to it's confluence with Great Brook in Exeter, were designated into the NH Rivers Management and Protection Program in August 1995.

Exeter River

The Exeter River has a long history of mills along its banks, and is now threatened by urban development. Raymond's Fordway Brook Watershed, is a major tributary to the upper Exeter River. The impacts are becoming severe in some areas, and unless management and targeted restoration projects are successful, invasive species, erosion, sedimentation, channeling, litter pile up, and other problems, will eradicate the habitat, fishing, boating, recreation, and other natural resources for future generations. The Exeter River Advisory Committee was formed, to provide this management role.

The Exeter River Local Advisory Committee

The Exeter River Local Advisory Committee (ERLAC) celebrated its 11th year of stewardship of the river and watershed in 2007. ERLAC partners with several organizations, including the Rockingham Planning Commission, NH Department of Environmental Services, NH Coastal Program, and NH Estuaries Projects (now referred to as the Piscataqua Region Estuaries Partnership), to provide ERLAC with an opportunity to work with the local Conservation Commissions to advocate effectively for the protection of natural resources throughout the watershed.

Each year, the Exeter River Local Advisory Committee holds several educational events and workshops, in various towns along its watershed, promoting the river, encouraging watershed restoration, and having the residents get involved. ERLAC works with the NH Coastal Program doing the "Volunteer Biological Assessment Program" (VBAP), which collects, sorts, and identifies macro invertebrates found on the river's bottom. Calculating the information obtained, gives a good Biological Water Quality Score for that site's water quality. This score is done by using the critter's tolerance to pollution scale rating, and the quantity of the critters counted.

Currently two sites are being surveyed along Fordway Brook, upstream of Route 102 and on Lane Road downstream of the culvert in the hollow. ERLAC is also working with NH

DES and the consulting firm Geosyntec, on a Watershed Restoration Plan. ERLAC has just completed the first phase, a Vulnerability Analysis, identifying sections of the Exeter River and it's watershed that is most impacted by development. The next phase involves management planning and restoration projects. For 2008, three priority sites have been identified, with Raymond's Fordway Brook being one.

ERLAC is a group of volunteers, and membership is open to any resident living in the watershed, recommended by their town's governing body, and appointed by ERLAC by the Department of Environmental Services. Raymond currently only has one member to ERLAC. During recent VBAP testing in 2007, at the Fordway Brook's Route 102 site, this member found the first ever recorded Oscillatoria Cyanobacteria, a variety of diatoms, on moving water's bottom. A cyanobacterium normally floats only on the water's surface of still ponds and lakes. This discovery is a concern to NH DES's Limnology Center. A brook walk and further tests will be done during 2008 to try and determine where these Cyanobacteria came from.

ERLAC also works to encourage land owners to put watershed areas in conservation easements to help protect the natural resources and help promote good water quality. The Exeter River Local Advisory Committee is always looking for volunteers[79].

The Lamprey River

The Lamprey River is a 47 mile river and watershed, with it's headwaters in the Town of Northwood and meandering through 13 towns until it reaches the Great Bay. The Lamprey River is a state designated "Rural River". The Lamprey River watershed is the largest tributary of the Great Bay Estuary, and as such has a significant effect on the quality and quantity of water in the bay. Siltation from storm water and poor protection is a grave concern for the future of this great bay.

Lamprey River

From the Bunker Pond Dam in West Epping to it's confluence with the Piscassic River in Newmarket, the Lamprey River has been designated a federal "National Wild and Scenic River." A portion of the river in the towns of Lee and Durham is also recognized under the New Hampshire Rivers Management and Protection Program". With these two designations, the lower Lamprey River can more readily receive federal and state grant funding for various projects. Many projects have and continue to improve this lower section of the river. Keeping this in mind, it is also important that similar work be done in the upper section of the river as everything flows downstream.

[79] http://www.exeterriver.org/

Lamprey River

What the river will look like generations from now; water quality; wildlife habitat; and other natural resources will be a direct consequence of the restoration and protection given to the river today. It is most important that the Town of Raymond, and the other towns in the upper section, promote the ecological health of the river, and work together to preserve and protect this watershed. Stormwater and severe flooding must be a priority part of this effort.

The Lamprey River has two organizations working to protect the watershed and river. The Lamprey River Advisory Committee was established to help preserve the two lower designated river sections. The Lamprey River Watershed Association was established to help preserve the entire 47 miles. In January 2008, the first annual Lamprey River Watershed Research Symposium was held at UNH, bringing together eight presenters of various UNH programs to share methodologies and results from their research, and more inter-program sharing of information. The second annual symposium was held at Raymond High School in the spring of 2009. The morning session consisted of the researcher's presentations and the afternoon session was centered of town management and policy making. Both sessions were open to the public. During 2007, Raymond Conservation periodically tested the river attempting to isolate the high e-coli, causing Carroll Beach closure[80].

Lamprey River Advisory Committee

The New Hampshire Rivers Management and Protection Program provides for the establishment of the Lamprey River Advisory Committee, or LRAC which is made up of volunteers from the towns of Epping, Lee, Durham, and Newmarket. The LRAC is mandated by federal and state programs to work help manage the lower section of the Lamprey River. At the time of establishing the federal designation, unfortunately, the Town of Raymond chose not to participate. Efforts are currently being made to address this with the intent of adding the Town of Raymond and the rest of the upper section of the river to the "National Wild and Scenic River" program soon. Although LRAC is distinct from the LRWA, the groups often collaborate in various efforts to protect and enhance the river as a whole.

[80] www.lampreyriver.org

Lamprey River Watershed Association

The Lamprey River Watershed Association, or LWRA, is also a group of volunteers. The volunteer members of the LWRA are recommended by the local Conservation Commissions in each town. There is currently only one member from the Town of Raymond serving on the LWRA and the Board of Directors. The LRWA is a group of concerned citizens promoting the restoration, conservation, wise development and use of the natural resources of the Lamprey River Watershed. Conserving fish and wildlife, forests, soil and water resources along with pollution abatement, and flood damage are key goals of the Association. Through education and research, the LRWA works to increase the understanding among citizens about the importance of conservation and natural resource protection in the watershed.

Streamwalk 2008 is one of LWRA's major grant funded projects. This project includes trained volunteers who walk the entire 47 miles of the river, logging significant erosion, patches of invasive species, tree over shading, trash, discharge pipes or culverts, and other indices of stream health. After the walk, the findings are prioritized and volunteer work crews, including Eagle Scout projects, eventually work on restoration.

LWRA's 2009 project is "Moving From Research to Action". This project involved hosting the symposium previously mentioned; hosting all-day conferences for town boards of newly passed laws; and offering customized presentations for towns sharing results of the Streamwalk 2008 project. The Lamprey River Watershed Association relies upon about 50 volunteers to participate in the "NH Volunteer River Association Program'. VRAP monitors the water quality of the river using various calibration equipment. The results are maintained by NH DES and reviewed by EPA. These tests are done by trained volunteers that must be recertified annually.

Starting in 2008, LRWA plans on starting the VBAP testing in several locations in the upper section of the river and then expanding this testing as NH DES funds permit. VBAP requires that a NH DES scientist be present during testing.

H. Stormwater Management

Effective stormwater management can prevent flash flooding, erosion, and pollution and sediment loading of streams, rivers, and watersheds. The treatment and management of stormwater becomes increasingly important with the growing amounts of impervious surface cover in New Hampshire's watersheds. One of the greatest threats to water quality nationwide begins with a storm. Rain washes over the landscape, picking up pesticides, fertilizer, sediment, oil, road salt, heavy metals, trash, toxic chemicals, and disease-causing microbes. As the percent of impervious surface approaches 10 percent, groundwater quality risk rises significantly.

Eventually, runoff (known as nonpoint source pollution) carrying this blend of pollutants runs into streams, creeks, estuaries, and coastal harbors where it degrades water quality

and threatens human health. Phase II of the Clean Water Act mandates communities to address this challenge, yet often many communities lack the information necessary to make cost-effective decisions about stormwater management systems that can protect water quality.

The University of New Hampshire Stormwater Center was established in 2004 to help public officials and others develop stormwater management programs to protect water quality. The center operates an independent field facility that tests stormwater devices and treatment systems in a side-by-side setting. This research could be used by the Town of Raymond as the planning board and town officials consider future stormwater management controls and conformity with EPA's Phase II Stormwater Management program. The Town of Raymond should also consider updating its drainage regulations and establishing limits on the amount of impervious surfaces on a lot to mitigate impacts from future flood events.

The NH DES has recently released the *New Hampshire Stormwater Manual* which provides guidance on stormwater regulations. The manual also outlines selection of best management practices, including low impact development strategies. The document is available for download at www.des.nh.gov.

Low Impact Design

Low Impact Design methods can be promoted by the Town of Raymond and included in the Town's Stormwater Management regulations to reduce the growth of impervious surfaces and encourage effective drainage solutions. Low Impact Development, known as LID, is the process of developing land while minimizing impacts on water resources and infrastructure.

Low Impact Development (LID) is an innovative stormwater management approach which is modeled after nature: manage rainfall at the source using uniformly distributed decentralized micro-scale controls. LID's goal is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source.

These techniques are based on the premise that stormwater management should not be seen as stormwater disposal. Instead of conveying and managing/treating stormwater in large, costly end-of-pipe facilities located at the bottom of drainage areas, LID addresses stormwater through small, cost-effective landscape features located at the lot level. These landscape features, known as Integrated Management Practices (IMPs), are the building blocks of LID.

Almost all components of the urban environment have the potential to serve as an IMP. This includes not only open space, but also rooftops, streetscapes, parking lots, sidewalks, and medians. LID is a versatile approach that can be applied equally well to new development, urban retrofits, and redevelopment/revitalization projects.[81] The

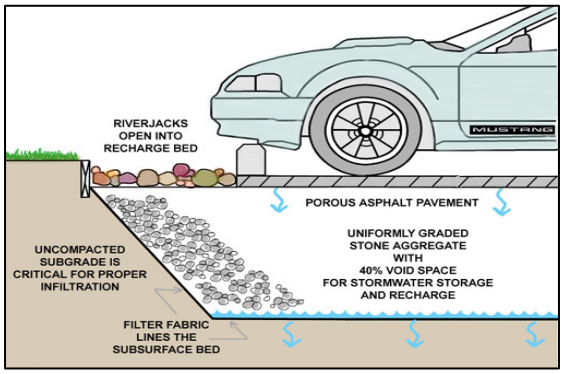
[81] www.lid-stormwater.net

Raymond Planning Board should consider updating its site plan, subdivision and stormwater management regulations to include LID and IMPs. The following photographs in Figure 13 demonstrate how one IMP -- porous asphalt can effectively infiltrate drainage and stormwater within a parking lot.

Figure 13
Porous Asphalt

Cahill Associates

Sample Parking Lot



Sample Cross Section

On a cumulative basis, the amount of impervious surface within a watershed can significantly increase damage caused by flood events. This is becoming more common in southern New Hampshire as more land is developed and paved. Table 73 shows the percent of land area covered by impervious surface in 1990, 2000, and 2005 in the Town of Raymond and adjacent towns.

Table 73
Impervious Surface Cover
Town of Raymond, NH and Adjacent Towns

Town	Land Area (acres)	Percent Imperviousness		
		1990	2000	2005
Candia	19,342	2.1%	4.1%	4.8%
Chester	16,620	2.5%	4.3%	5.1%
Raymond	**18,448**	**5.3%**	**8.0%**	**9.3%***
Deerfield	32,587	1.5%	2.4%	3.0%
Nottingham	29,880	1.5%	2.3%	2.8%
Epping	16,468	4.0%	6.5%	7.8%
Fremont	11,036	3.0%	4.9%	5.9%

Source: State of the Estuaries 2006, New Hampshire Estuaries Project Pg 24-25.
*Note: The increase in impervious surface largely reflects the building area and pavement surrounding the Wal-Mart Distribution Center at Exit 5.

As indicated by Table 73, the amount of impervious surface in the Town of Raymond increased from 5.3 to 9.3 percent between 1990 and 2005. Raymond's percent imperviousness noticeably exceeds the adjacent communities of Candia, Chester, Deerfield, Nottingham, Epping and Fremont. The recent flooding events in the Town of Raymond in 2006 and 2007 should give community planners pause to reflect how and where impervious surfaces may have increased flood damage within the community. The spring floods in 2007 washed out a portion of NH Rt. 102 and closed Exit 5 in one direction for a long period of time. Global climate change and sprawling patterns of growth will continue to place pressure on Raymond's natural resource base and the ability of the natural land to absorb runoff during times of greater rainfall or snow melt. In addition, the Town of Raymond's land use regulations pertaining to impervious surfaces and lot coverage should be reviewed in light of recent events and growth trends.

In addition to this data, the Piscataqua Region Estuaries Partnership has prepared the following map showing the amount of Impervious Surfaces and Conservation Areas within the Town of Raymond as of 2005. Low Impact Design regulations can help to mitigate the effects of stormwater runoff and flood damage resulting from increased permeability. Many towns in New Hampshire are adopting new stormwater management regulations which incorporate low impact design standards. These new regulations can be used as a model for the Town of Raymond. Landscape design standards for stormwater treatment are an important part of these new regulations and are used to reduce runoff and alteration of hydrology. An example of how some of these standards could be used in Raymond is outlined below and in Table 74:

> Landscaping that incorporates Low Impact Development (LID) strategies for stormwater management should serve to meet the requirements of the Town of Raymond's stormwater management plans and regulations by absorbing and treating stormwater runoff to the greatest extent possible onsite. LID landscaping includes the use of vegetated BMP's and other features that use soil and landscaping to mimic natural hydrologic features and functions. The high organic content of the soils encourages healthy growth and absorbs and retains rainwater on site as soil moisture, minimizing irrigation needs and runoff quantities.
>
> Landscape areas shall include all areas on the site that are not covered by buildings, structures, paving or impervious surface. The selection and location of turf, trees, ground cover (including shrubs, grasses, perennials, flowerbeds and slope retention), pedestrian paving and other landscaping elements shall be used to absorb rainfall, prevent erosion and meet the functional and visual purposes such as defining spaces, accommodating and directing circulation patterns, managing landscape impacts, attracting attention to building entrances and other focal points, and visually integrating buildings with the landscape area. Where possible, the landscaping design should combine form and function, incorporating drainage features invisibly into the landscape such as through shallow detention areas, parking lot islands that provide for infiltration of parking lot runoff and sheet flow.[82]

[82] See Town of New London Subdivision Regulations Appendix A: STORMWATER LOW IMPACT DEVELOPMENT PRACTICE – DESIGN CRITERIA for numerous examples of LID.

Table 74
List of BMP's Acceptable For Improving Water Quality

Group	Practice	Description
Ponds/Wetlands	Micropool Extended Detention Pond	Pond that treats the majority of the water quality through extended detention, and incorporates a micropool at the outlet of the pond to prevent sediment buildup.
	Wet Pond	Pond that provides storage for the entire water quality volume in the permanent pool
	Shallow Marsh	A wetland that provides water quality treatment primarily in wet shallow marsh
	Extended Detention Wet Pond/Wetland	Pond/wetland that treats a portion of the water quality by detaining storm flows above the permanent pool for a specified minimum detention time.
Infiltration	Infiltration Trenches/Chambers/Dry Wells	An infiltration practice that stores the water quality volume in the void spaces of gravel trench or within an open chamber before it is infiltrated into underlying soils within the B or C soil horizons
	Infiltration Basin	An infiltration practice that stores the water quality volume in the void spaces of a gravel base before it is infiltrated into the underlying soils within the B or C soil horizons.
Alternative Paving Surfaces		A practice depression that treats stormwater as it flows through a soil matrix, and is returned to the storm drain system, or infiltrated into underlying soils or substratum
Filtering Practices	Bioretention	A shallow depression that treats stormwater as it flows through a soil matrix, and is returned to the storm drain system, or infiltrated into underlying soils or substratum.
Open Channels	Dry Swale	An open vegetated channel or depression explicitly designed to detain and promote filtration of stormwater runoff into underlying fabricated soil matrix
	Wet Swale	An open vegetated channel or depression designed to retain water or intercept groundwater for water quality treatment.
Green Roofs	Extensive	Rooftop vegetated with low, drought-tolerant plant species and a shallow planting media designed for performance. Not typically designed for public access
	Intensive	Rooftop vegetated with trees and shrubs with a deeper planting soil and walkways, typically designed for both performance and public access

Town of New London's Stormwater Management Regulations

It should be noted that while the above referenced BMPs can help to improve water quality, the use of open channels and ditches can also have a negative impact in spawning mosquitoes and providing nesting areas for disease borne insects. Therefore, caution must be considered to prevent an overuse of these techniques.

I. Ground Water Resources

Most of the drinking water supply in Southern New Hampshire is provided by stratified drift aquifers. Stratified drift aquifers are made up of deposits of sand and gravel located above the bedrock. Although these aquifers are more effective in water transmission than are bedrock aquifers, stratified drift aquifers are much more susceptible to contamination. Leaking underground storage tanks, poorly maintained septic systems, improper disposal of hazardous chemicals, vehicular accidents and gravel pits are the leading sources of this contamination. Another large problem concerns development above aquifers. These areas are favorable largely because of the levelness of the land and ease of extracting gravel. However, this development often leads to contamination, since work is completed close to the water source.

An aquifer consists of underground soil or rock that groundwater is easily able to move through. Aquifers typically consist of gravel, sand, sandstone, or fractured rock. Water from fractured bedrock provides 25 percent of New Hampshire's drinking water and 65 percent of the water for private domestic wells (source: NH DES). During years of drought, some wells dry up and homeowners are forced to drill new wells for domestic water. It is important to protect groundwater within existing or potential public drinking water supply aquifers. Aquifers, like wetlands, serve as a place of storage for water.

The U.S. Geological Survey has identified several extensive potential high-yield aquifers within the Town of Raymond. A potentially very productive aquifer lies within northwest Raymond, and the report titled "*Groundwater Resources of the Lamprey River Basin, Southeastern New Hampshire*," states that the aquifer in northwest Raymond may yield 1.7 mgal/day. This aquifer as a result may be ideal for the production of drinking water for the Town of Raymond.

New Hampshire's Groundwater Protection Act (RSA 485-C) is in place to protect current users from adverse affects of large groundwater withdrawals. By definition, a "large groundwater withdrawal" is one that draws more than 57,600 gallons in any 24 hour period. Since 1998, any new large groundwater withdrawal must go through a permitting process which includes public hearings, extensive testing, data assessment, monitoring, reporting, and mitigation plans. The act prevents adverse impacts to other users such as decreases in groundwater quantity and quality for wells, lakes, wetlands, and other water resources.

Other aquifers located in Raymond are: the West Epping and Newmarket Plains aquifers; an esker[83] aquifer in the general area easterly of intersection of Routes 102 and 107, northerly of Prescott Road; and a kame terrace[84] in western Raymond, along the North Branch Lamprey River extending into the Town of Candia. Several relatively large potential medium-yield aquifers have also been identified in proximity to these locations.[85]

The Town of Raymond has adopted groundwater protection regulations through the establishment of Zone I – Groundwater Conservation District. Some of the major performance standards of this district include:

1 Stormwater management plans prepared pursuant to paragraph A shall demonstrate that stormwater recharged to groundwater will not result in violation of Ambient Groundwater Quality Standards (ENV-Ws 410.05) at the property boundary

2 Animal manures, fertilizers, and compost must be stored in accordance with Manual of Best Management Practices for Agriculture in New Hampshire, NH Department of Agriculture, Markets, and Food, August 1998, and any subsequent revisions

3 All regulated substances stored in containers with a capacity of five gallons or more must be stored in product-tight containers on an impervious surface designed and maintained to prevent flow to exposed soils, floor drains, and outside drains

4 Outdoor storage areas for regulated substances must be protected from exposure to precipitation and must be located at least 50 feet from surface water or storm drains, at least 75 feet from private wells, and outside the sanitary protective radius of wells used by public water systems[86]

J. Source Water Protection

The New Hampshire Department of Environmental Services (NH DES) conducts an evaluation of the existing source water assessment data available for all the active public water systems located within a community. This section provides a summary of the NH DES Source Water Assessment Report of the vulnerability of each source used by the

[83] Esker is is a long, winding ridge of stratified sand and gravel, examples of which occur in glaciated and formerly glaciated regions. Eskers are frequently several miles in length and, because of their peculiar uniform shape, somewhat resemble railroad embankments.

[84] Kame terrace is a flat-topped mound or hill composed of sorted sand and gravel deposited by meltwater in a former glacial lake

[85] Town of Raymond Open Space Plan, 2003. Pg 31

[86] For complete list of Performance Standards for this district see Town of Raymond Zoning Ordinance section 4.243

public water system(s) located in Raymond. There are three types of public water supply systems identified within the NH DES Source Water Assessment Report for the Town of Raymond, NH. These systems include:

- **Community Systems** a public water system which serves at least 15 services connections used by year-round residents or regularly serves at least 25 year-round residents.
- **Non-Transient/Non-Community Systems** a public water system designed to serve at least 25 people, for at least 6 months per year. Examples include day care, schools, and commercial property.
- **Transient/Non-Community Systems** a public water system designed to serve at least 25 people, for at least 60 days per year. Examples include restaurants, campgrounds, motels, recreational areas, and service stations.

The NH DES Source Water Assessment Report indicates that there are a total of 29 public water supply wells in Raymond of which 24 are community wells and five are transient. Because the location and description of these wells and known contaminated sources and potential contaminated sources have changed since this assessment was performed, the Planning Board authorized the Southern New Hampshire Planning Commission to apply for 2008 Source Water Protection Grant to be used to conduct a new potential contamination source inventory and to update the Town's groundwater protection district regulations and aquifer boundaries.

This project will encompass the entire geography of the Town of Raymond and will also identify and address all the active public water supply sources located within the town, including an evaluation and update to the Town's aquifer protection zoning district boundaries. The grant will also focus on the town's aquifer and groundwater protection needs and include updated well summary reports. The primary purpose of this grant is to identify and implement appropriate measures for source water and ground water protection within the Town of Raymond.

K. Flood Hazard Areas

A floodplain is typically flat or nearly flat land located adjacent to a stream or river which experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current. The Federal Emergency Management Agency (FEMA) has prepared Special Flood Hazard Area maps for the Town of Raymond for the purpose of identifying the 100-year flood area within the community that may be eligible for federally subsidized flood insurance. These 100-year flood boundaries are for the most part associated with the Lamprey and Exeter Rivers, Fordway and Dudley Brooks, and Onway and Governors Lakes.

Examples of 2007 Flood Damage in Raymond, NH

The Town of Raymond adopted a Floodplain Ordinance in March 1997 which is part of the Town's Zoning Ordinance. This ordinance regulates activities in the floodplain, consistent with FEMA requirements. In addition, the Planning Board's Site Plan and Subdivision Regulations, and the Zoning Ordinance all include additional information regulating proposed activities in the floodplain.

The Town of Raymond also participates in the National Flood Insurance Program (NFIP). As a part of the SNHPC's Regional Comprehensive Plan (RCP), which was completed in the fall of 2006, an inventory of structures within special flood hazard areas (SFHA) or 100 year floodplain was conducted, as well as information pertaining to claims information. The RCP indicated in 2006 the Town of Raymond had 303 residential structures and 15 non-residential structures located within the SFHA. In addition, there were 21 claims totaling $76,985 and 7 claims for repetitive loss which totaled $45,298.[87]

During the recent flooding events in Raymond which occurred in May of 2006 and April 2007, the Town of Raymond experienced a significant number more claims. As a result of these flooding events, the Town of Raymond and many of communities also hard hit by 2007 flood requested that the State and FEMA update the flood maps. In addition, town officials considered utilizing the 500-year limits as shown on the FEMA flood insurance maps as more representative of the town's flooding characteristics.

In response, the State of New Hampshire conducted a $300,000 study funded by FEMA in 2008 to determine the causes and differences between the April 2007 flood and the May 2006 flood. The study also examined the policies, programs and mechanisms for coordination of flood control operation, notification of flood-prone areas, and assessing the effects of dam operations. The results of the study found that the May 2006 even was caused by extremely heavy rainfall while the April 2007 event was caused by a

[87] See table 10.1 in the Southern New Hampshire Regional Planning Commission's Regional Comprehensive Plan, 2006.

combination of rain and snowmelt. In addition, the study found that dam operations generally did not aggravate flooding and that actions to mitigate future flooding range from improving floodplain management and flood forecasting to using a watershed-based approach to flood operations. Based upon these recommendations, the Town of Raymond should be prepared to utilize and expand upon this study by retaining an engineer to work with FEMA to update existing floodplain maps and base flood elevations, and recommend specific changes and improvements to the Town's floodplain development regulations.

L. Open Space

The conservation of forest lands, open spaces, wildlife habitats, and areas of cultural importance have been important in the Town of Raymond's planning initiatives for many years. Raymond's Conservation Commission and Planning Board participated in the Regional Environmental Planning Program (REPP) in 1998 and 1999 identifying a total of ten parcels of land worthy of protection totaling 1,013 acres. Seven sites totaling 703.6 acres fall under the water resources category of which 493 acres were designated for wetland protection and 210.6 acres for shoreland protection. Two watershed protection sites totaling 274.5 acres were listed in the category of land and forestry resources and one site (Chandler's Mine) consisting of 35.2 acres was placed in the geologic and topographic resources category as being a prominent natural feature of the community.

More information about these sites is identified in the Raymond's 2003 Open Space Plan. In addition to these sites, the 2003 Open Space Plan identified a number of areas within Raymond as desirable locations for open space preservation. A total of 14 sites were identified.

These sites include: Norris Farms/Flint Hill; Dearborn Estates; Manchester-Portsmouth Railroad Bed; Cassier-Eames property, Chandler's Mine, approximately 335 acres for watershed protection, Onway Lake, and a number of tax parcels totaling approximately 800 acres.

In addition, other areas identified for protection include several sites from the Town Forester's Report of 2001 which includes the Town ball field and well, Lamprey River Elementary School, town beach and scenic forest, Industrial Drive lots, Bald Hill Road and Shattagee/Lane roads lot.

The Town of Raymond's 2003 Open Space Plan also made several important recommendations for future open space planning. One goal was to encourage new development to occur in a logical manner, consistent with smart growth principles, and discourage development that will result in sprawl and unsustainable growth patterns. This would be achieved by encouraging innovative techniques in subdivision design, such as development of brownfields and utilization of New Hampshire's Smart growth toolkit, by

integrating the built infrastructure with both the green infrastructure that retains rural character and the social infrastructure that supports vibrant community life.

In addition to Raymond's 2003 Open Space Plan, the Town's conservation development ordinance also enumerates many important factors in conserving natural resources as part of the development process. Conservation development has been an important tool which the Town of Raymond and other towns in the SNHPC region have used to protect open spaces for a variety of uses. Raymond's zoning ordinance defines conservation development in Section 4.302 as:

> "A subdivision of land consisting of protected open space and single-family detached homes located on unconventional lots that would not otherwise be permitted by the minimum lot size, frontage and yard requirements of this Ordinance. Private roads built to Town standards are permitted in a Conservation Subdivision, but a Homeowner's Association must be established to maintain the roads."

Under this approach, the Planning Board works with the developer to fit the development into the landscape in a way that maximizes the protection of important natural and cultural amenities on the site and maintains the character of the community. The conservation subdivision approach also supplements efforts to protect whole parcels through outright purchase or conservation easement. However, as housing demand and land values increase, conservation easements or the outright purchase of land are proving to be increasingly costly. Thus, communities need to pursue a variety of approaches for managing growth, protecting important resources, and maintaining community character.[88]

Conservation subdivisions also provide numerous economic, environmental, and social benefits to a community. Some of these benefits include:

- Reducing the area of land over which homes will be built can reduce the cost of developing the lots, which in some cases can translate to lower housing costs;

- Future service costs for public infrastructure, such as roads, sewers and water lines, are reduced because roads and water/sewer lines can be shorter within a Conservation Subdivision approach;

- These subdivisions generally create less impervious surface, thus reducing stormwater runoff to local water bodies, such as rivers and streams.[89]

[88] Paragraph taken from a draft chapter of the forthcoming, Innovative Land Use Planning Techniques: A Handbook for Sustainable Development, forthcoming publication date 2007, prepared as part of the Regional Environmental Planning Program by the NH Department of Environmental Services, the NH Association of Regional Planning Commissions, the NH Office of Energy and Planning, and the NH Local Government Center.

[89] Ibid.