Ashuelot River Local Advisory Committee

Ashuelot River Corridor Management Plan

2006 Update

Table of Contents

Acknowledgments ii
Corridor Management Plan Mission Statement iii
Local Advisory Committee Membership 2006 iii
Executive Summary iv
Glossary ix

River Management Plan

Introduction 1

Butterfield Pond, Washington to the Stone Arch Bridge, Gilsum . 2

Stone Arch Bridge, Gilsum to the Stone Arch Bridge, Keene . 6

Stone Arch Bridge, Keene to the Branch River, Keene . . 11

Branch River, Keene to the Mill Street Bridge, Winchester . . 16

Mill Street Bridge, Winchester to the Former McGoldrick Dam site, Hinsdale. 20

Former McGoldrick Dam Site, Hinsdale to the Connecticut River, Hinsdale 22

Appendices

Appendix 1. Management Tools . . . . . 1.1 - 1.6
Appendix 2. Local Land Use Planning . . . . 2.1 - 2.5
Appendix 3. Annotated Directory of Assistance . . . 3.1 - 3.8
Appendix 4. Regulations for Designated Rivers . . . 4.1 - 4.5
Appendix 5. Land Use & Soil Conditions . . . . 5.1 - 5.7
Appendix 6. Water Quality Monitoring . . . . 6.1 – 6.9
Appendix 7. TNC Land Conservation Plan 7.1

Acknowledgments

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Ashuelot River Corridor Management Plan
Mission Statement

The Ashuelot River and its corridor continue to experience pressure for increased development, recreation and other uses of its natural and cultural resources. This trend will likely continue in the future. It is essential to have a management approach that ensures a balance between protection of legitimate community interests and the rights of property owners along the river, in order to protect and improve the existing resource values of the River and its corridor.

The Ashuelot River Corridor Management Plan proposes a management approach with the mission of protecting plentiful clean water, thriving riparian and aquatic habitat for wild plants and animals, providing balance for continued development of land use and water uses, recreation, and other public needs.

The Ashuelot LAC presents the Ashuelot River Corridor Plan to local officials for consideration in the conventional local planning process, asking Planning Boards to review the Plan and adopt it as an adjunct to the local Master Plan. Planning Boards are encouraged to integrate recommendations from the Plan into local land use planning as they deem appropriate.

Ashuelot River Local Advisory Committee
Membership 2006

Barbara Skuly, Chair—*Swanzey*
John Asseng – *Marlow*
Pat Eggleston—*Keene*
Pablo Fleischmann—*Gilsum*
Barbara Fostyck - *Hinsdale*
Roger Sweet—*Sullivan*
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Executive Summary

Planning Process

In 1992, area residents with the support of local officials from Washington to Hinsdale, nominated the Ashuelot River for enrollment in the State's "Rivers Management and Protection Program" by the NH Legislature. The nomination was based in an inventory of natural and cultural resources that define the character of the River Corridor. While some of those resources are common to rivers around the globe, many are unique to the Ashuelot. The nomination was approved and in 1994 NH DES convened the Ashuelot River LAC. The NH Rivers Program stipulates that LACs' duties include preparing an advisory plan for the management and protection of the natural and cultural resources of each designated River Corridor.

The LAC undertook a planning process of research and deliberation that began with review and discussion of the nomination document, and included expert presentations to the LAC on a variety of topics ranging from migratory fish restoration in the Connecticut River watershed to local subsurface contamination in Keene (see Acknowledgments). The LAC also weighed the importance of places, problems and opportunities by criteria such as the level of need or the ability to affect change.

From these discussions and presentations the Committee found that the River can be described as a series of segments that vary from one another in land form, development, and ecology. The Committee found it useful to delineate distinct segments for the purposes of understanding the River Corridor resources, threats to resource values, opportunities for use and protection of resources, and in general to develop a management approach for conservation of resources. These river segments are the basis for the chapters of this Plan:

- Butterfield Pond in Washington to Stone Arch bridge in Gilsum;
- the Stone Arch bridge, Gilsum to the Stone Arch bridge, Keene;
- the Stone Arch bridge Keene to the confluence of the Ashuelot and Branch Rivers in Keene;
- the confluence of the Branch to the Mill Street bridge in Winchester;
- Mill Street Bridge in Winchester to the former McGoldrick Dam site in Hinsdale; and
- former McGoldrick Dam site to the confluence with the Connecticut River in Hinsdale.

The LAC presented the first Corridor Management Plan for public review and consideration by municipal officials in 1998. By 2001 the Planning Boards of eight of the ten corridor towns had formally included the Plan by reference or incorporation into their respective Master Plans.

This is an update of the 2001 Plan. The body of the Plan is unchanged in format and scope. This update primarily reflects changes in the status of development plans, community plans and dam removals. An important addition here is a synopsis of the LAC's ongoing Volunteer Water Quality Monitoring Program, begun in 2001 (Appendix 6). Another significant change referenced here is the completion of "A Land Conservation Plan for the Ashuelot River Watershed" published in 2004 by The Nature Conservancy as one of two pilot projects nation wide to develop landscape-scale conservation plans. The Ashuelot was chosen for its exceptional water quality, stream habitat and upland habitat conditions.

Findings

The committee recognized that several issues, including preventing non-point source pollution, managing public access to the corridor, and protecting soil are pressing throughout the River Corridor. The LAC also discovered many issues which are unique to individual segments of the River or even site-specific. Local issues typically involve historic resources, special plant and animal habitats, or subsurface contamination.

The character (and the management issues) of the River Corridor change gradually from its headwaters in Pillsbury State Park to its mouth at the Connecticut River. Protecting the values of undeveloped forest (wild plant and animal habitat, clean water, and marketable timber) dominate concerns through the headwaters segment. From Keene south to the Connecticut River, cleaning up contaminated soil, protecting floodplain from development, and cleaning up storm water runoff are priorities for action. Public access to the Corridor is an important issue throughout the Corridor as is the prevention of soil erosion and non-point source pollution.

Public education to develop stewardship of the Corridor resources is a top priority for LAC action. Other tools include local land use standards, existing state programmatic or regulatory standards, cooperation among private and public interests, and in some cases developing new programs at the state, regional, or local levels. The LAC supports a cooperative approach to resource conservation, an approach that acknowledges both the prerogatives of private ownership and the public benefit of regulating private activity to prevent loss of our shared natural and cultural heritage.

The LAC findings can be arranged in two groups 1) resources in need of conservation and 2) issues that call for management at the private, local, regional, and/or state levels:

Resource Conservation Issues:

- Water Quality Protection and Monitoring
- Public Access for Recreation in the River and Riparian Lands
- Conservation of Soil Potential
- Conservation of Plant and Animal Habitat
- Conservation of Green Space
- Conservation of Historic and Archeological Resources

Management Issues:

- Potential for Development of Private Property
- Growth of the Regional Tourism Industry
- Public Access for Recreation in the River and Riparian Lands

Finally, below (in no particular order) are descriptions of twenty issues which arose most frequently or were otherwise found to be priorities for action during the LAC's planning process.

Priority Issues in the Ashuelot River Corridor

CONSERVATION

1. Conservation of Plant and Animal Habitat. This includes upland, river bank and instream habitats. The Corridor hosts rare and endangered plant and animal species. Habitat protection also benefits the many far-ranging animals for which the unique river corridor is a part of their range (e.g. migratory songbirds, migratory fish, moose, fishers, and deer). Habitat protection in the River Corridor also includes the goal of maintaining natural riparian buffers. Preventing deforestation of river banks has profound benefits of protecting soil, water quality, open space, and plant and animal habitat.

2. Land Conservation. Protection of undeveloped land by purchase or donation of land or development rights. The benefits of land conservation are many and varied.

3. Preservation of Historic and Archeological Resources. The River Corridor has many historic places, buildings, and structures both in village centers and dispersed through uninhabited reaches of the River. Many are protected by state or local recognition, but many are not. Aside from the natural features of the Ashuelot, historic features may best define the character of the Corridor. Archeological resources are typically buried and unseen making them especially susceptible to accidental destruction during excavation.

4. Prevention of Soil Erosion. The loss of soil from construction sites, logging roads, or any unstable excavation site has dual impacts: 1) loss of soil potential on-site and 2) sedimentation of surface waters receiving the sediment. Excavation practices that reduce erosion, while commonly known and easily implemented, are too often not used.

5. Protection of Ground Water (Stratified Drift Aquifers). The Ashuelot Corridor is the focal point of the River's watershed. The lower Corridor is underlain by rich sand and gravel deposits, which supply the Keene, Swanzey, Winchester, and Hinsdale municipal systems today and represent tremendous water supply potential to other towns.

6. Preservation of Agricultural Land. Preservation of agricultural land is a difficult economic situation due to the high value of farmland for development. Farmland preservation has several benefits, including preservation of local agricultural potential, preservation of rural character, and protection of open space for habitat and landscape views.

7. Protection of Tributaries: Explore opportunities to enroll major tributaries in the NH Rivers Program, such as the Branch River, the South Branch Ashuelot River and the Minnewawa.

8. Prevent Loss of Wetlands. Loss of wetlands, like loss of riparian forest and floodplain, is known to have serious negative implications for biological diversity, water quality, and watershed hydrology. Wetland protection is equally important in upland and riparian settings.

9. Prevent Development of Floodplain Lands. The historic use of floodplain in the lower Corridor for farming did not preclude the hydrologic values of that floodplain. However, conversion of farms to residential, commercial and industrial development does. Building and paving on floodplains in the recent decades have led to a critical loss of floodwater storage. Loss

of flood storage has both economic and ecological consequences: flooding is worsened down stream and natural cycles of flooding (which create unique plant and animal habitat on floodplains) are lost.

HUMAN IMPACT

10. Enhancing Responsible Public Access. There are several approaches to providing public access including publicly-owned access areas, public parking, encouraging private land owners to allow public access, and most importantly, public education regarding responsible use of private property and public resources.

11. Storm water Runoff Management. Snow melt and rain water carry sediment, plant nutrients, and toxic substances from construction sites, lawns and paved areas to surface water. Paved surfaces, especially those with car and truck traffic, including driveways, require special attention for preventing direct discharge of runoff to streams.

12. Surveillance and Enforcement Regarding Private Septic System Failure. Shoreland often hosts high-density development for seasonal and year-round housing. Release of pathogens, chemicals, and nutrients to surface water by failed or inadequate septic systems can have profound consequences for both human health and aquatic ecology.

13. Prevent Non-Point and Point Source Pollution. The release of pollutants into the air, water, and soil remains a problem wherever there is development. Each of us in our daily routines leaves a trail of air pollution, wastewater, and solid waste. It becomes clear that in order to prevent pollution we must modify our use of products and technologies that lead to creation of poisonous waste products.

14. Land Use Controls for Development on Steep Slopes. Soil erosion and loss of special habitats after poorly designed building or timber harvest on steep slopes are persistent threats in the area's uplands.

15. Prevention of Eutrophication. Runoff of plant nutrients from lawn fertilizer and the effluent from wastewater treatment facilities can lead to excessive plant growth in the River which in short term can lead to the consumption of free oxygen from the water when the plants decay. Warm water temperatures caused by loss of shade from deforestation of riverbanks also contributes to eutrophication. Eutrophication can be lethal to native aquatic animals and can also have human health consequences. Eutrophication can also lower market values of lakefront and river front properties.

18. Support Local Action to Clean-up Subsurface Contamination Sites. The high cost of cleaning up soil and ground water contamination finds municipalities relying on state and federal environmental funding programs. Competition for those funds is substantial. Regional support for municipal requests for funding can improve the likelihood of funding and the elimination of serious environmental hazards. There are high priority sites in Keene and Winchester.

19. Invasive Species: Educate the public and governments about the importance of preventing the spread of invasive plant and animal species in all habitat's, but particularly the especially susceptible riparian habitats.

20. Setback Requirements: Encourage the adoption of setback requirements for construction and alteration of terrain in municipal zoning from the shoreline of perennial streams in the watershed.

PLANNING

21. Enhance Cooperation Among Local Government, Private Organizations, and Academia. There are many individuals and groups with interest, expertise and resources to act on River Corridor management issues. Networking among local government, schools, colleges, business organizations, and private conservation organizations improves the effectiveness of management.

22. Management of Tourism Development. Tourism can provide an economic incentive for conserving our natural and cultural heritage -- many travelers visit the Ashuelot Corridor because of its special features. However, over-exploitation of the Corridor's attractiveness can actually destroy those features by crowding them with incompatible development or literally trampling natural areas.

23. Public Education to Promote Stewardship. It is a proven dynamic that protection of any resource will become a way of life where there is a highly developed sense of shared ownership, appreciation, and responsibility for that resource.

24. Integrate Corridor Management Plan with Local Master Plans. Many of the management issues identified by the LAC already appear in local Master Plans and less frequently, in local land-use standards. Inclusion of policies and measures to address these issues in local government for all ten Corridor towns is an important step toward fulfilling the goals of this Plan and the NH River Program.

25. Support NH Department for Environmental Services Instream Flow Regulation. The NH Department of Environmental Services is responsible under the NH Rivers Management and Protection Program for establishing rules for monitoring and maintaining minimum instream flow volumes for all protected rivers. Local understanding and support of local and regional activity will ensure successful implementation.

NH DES anticipates completing the Instream Flow Regulation (Watershed Planning) pilot projects for the Souhegan and Lamprey Rivers in October 2007. This approach calls for monitoring and managing water resources throughout the watershed to understand and protect natural flow regimes. The plans will include all registered water users along the designated river and all tributaries in the watershed, and all affected dams. Future legislation will direct the development of similar plans for the State's remaining watersheds, and watershed planning will proceed based on priorities that are yet to be determined in 2006.

26. Trail Easements/Development. Develop public hiking trails within the Corridor where environmentally appropriate.

Glossary

aquatic ecology

the network of relationships between living and non-living things in streams, ponds, etc.; relationships based on the use of energy and material driven by chemistry and biology.

aquifer

geologic material, e.g. gravel, bedrock, or sand, which contains water beneath the earth's surface; while water is found in soil and rock almost everywhere, aquifers are isolated formations with enough water to supply human needs.

aquifer protection

practices, regulation, or engineering designed to prevent pollution of aquifers and the water contained in aquifers and prevent the depletion of water in aquifers.

aquifer, stratified drift

sand and gravel buried beneath the earth's surface which was deposited by running water in the prehistoric past; running water sorted the sand and gravel by the size of particles; stratified drift sand and gravel typically makes good aquifers because of space between particles 1) can fill with water and 2) allow water to flow through the deposit quickly.

best management practices (BMP)

guidelines for working with sensitive materials in sensitive areas to avoid damage to or loss of resources; can apply to soil excavation, manufacturing with chemicals, timber harvest, lawn care, etc.

cultural heritage

physical or intangible remnants of past ways of life, e.g. historic buildings or village settings, literature, music, technology, community events, etc.

cultural resources

physical features or characteristics of manmade or natural environments which contain, convey, or impart cultural heritage.

deforestation

literally: removal or loss of forest; in environmental management the term implies a trend of irrevocable conversion of land from forested to developed.

biological diversity

the variety of genetic material demonstrated in the variety of living things: bacteria, fungi, plants, and animals; each species represents a complete and unique combination of genetic material; extinction of species eliminates that genetic combination and its function in the ecosystem forever.

eutrophication

aquatic ecosystems depend on a balance of oxygen production with oxygen use: living plants make oxygen, living and decaying animals and decaying plants use oxygen; when plant growth is excessive (because of the addition of abnormally large amounts of plant nutrients, e.g. sewage or fertilizer) the decay that follows uses more oxygen than is produced causing an oxygen poor ecosystem.

Glossary

floodplain

land regularly subjected to flooding during seasonal high water or other periodic flooding - typically flat land adjacent to the river banks; the landscape and plant life on floodplains are shaped by flooding.

flood water storage

diversion and retention of flood water away from stream channels during floods - typically as water spreads over floodplains and fills wetland rather than accumulating in the stream channel and increasing the height, speed, and power of flood water in the stream; water stored in floodplains and wetlands is released slowly to the stream or seeps into the ground.

free oxygen

oxygen molecules not combined with other chemicals in water or air; land and water animals need free oxygen for respiration.

green space

undeveloped land occurring either in natural undisturbed settings or as part of development design; may be vegetated with natural vegetation or landscaped.

ground water

water present beneath the earth's surface in spaces between particles of soil, sand, and gravel, and in bedrock fissures; ground water feeds streams and ponds.

habitat

the kind of place that provides a plant or animal species with what it needs to survive and reproduce; these places are defined by geology, altitude, climate, and other plant and animal species present; species may have very specific habitat requirements and be unable to survive under other conditions, or, species may be very flexible about habitat characteristics.

high density development

a subjective term implying areas where structures and impervious surfaces dominate the landscape, e.g. downtowns, shopping plaza, and apartment complexes.

hydrology

the study of the movement and behavior of water in the environment.

impervious surface

any surface through which water may not pass, e.g. asphalt, concrete, roof tops, and dirt packed by machinery.

impoundment

surface water retained by a dam; may be a stream impounded to create a pond, a natural pond enlarged by a dam, or a river elevated and widened by a dam.

LAC

a volunteer citizen group established by the Commissioner of the NH Department of Environmental Services to plan for the management of river corridors enrolled in the NH River Management and Protection Program.

Glossary

Master Plan

documentation of policy and goals, existing conditions, and expected future conditions regarding land use, public infrastructure, and other public interests; typically prepared by local planning boards and are required for local zoning, capital improvements programming, and growth management.

migratory fish

fish species whose life cycle requires travel between fresh water of rivers and salt water of estuary or ocean to complete their life cycle; e.g. adult salmon live in ocean, return to streams to mate, eggs and young grow in streams, young migrate to ocean for adult life; adult female American eels live in streams and migrate to estuaries to mate, young migrate upstream.

minimum instream flow

volume of water flowing in a river designated in the NH Rivers Management and Protection Program needed to balance ecological & social needs of a river; flow volumes are specific to rivers, parts of rivers and seasons of the year; used to regulate water withdrawals from designated rivers.

non-point source pollution (NPS)

pollution not discharged to the environment from a single point, rather, from many sources over large areas, e.g. car exhaust, lawn care chemicals, and septic leachate.

nutrient

any of several chemicals required by plants for growth and reproduction: principally, phosphorous and nitrogen.

nutrient enrichment

release of excessive concentrations of plant nutrients into water; may originate from fertilizer applied to crops and lawns or from disturbance of forest soils and leaf litter which maintain a reservoir of nutrients.

public access

use of land or water areas by the general public; may be informal or specially designated.

rare and endangered species

endangered: plant or animal species at risk of becoming extinct in all or part of its range within NH; rare: plant or animal species at risk of becoming endangered in the near future; extinction can result when death of individuals occurs faster than reproduction, loss of habitat which prevents reproduction, or other barriers to reproduction, e.g. infertility caused by chemicals.

resource values

benefits provided by the use or simply the presence of resources.

riparian

describes land adjacent or near streams and rivers and linked with the river by hydrology and ecology; distance from stream will vary with the topography and land use - in very steep and rugged areas, only land very close to the stream will be considered riparian, in broad expansive valleys the river may influence land a mile or more from the bank due to flooding.

Glossary

riparian buffer

undeveloped land adjacent to the river which retains natural or rehabilitated vegetation; riparian conditions are part of the stream ecosystem.

river basin

see watershed

river segment

see statutory river segment

sedimentation

the accumulation of sand, silt, or other sediments in the water and on the bottom of streams, pond, wetlands.

shoreland

land area within 250 feet of the water line of rivers and ponds pursuant to the NH Shoreland Protection Act.

site plan review

standards for information included on a plan for a proposed change of use or substantial expansion of an existing use.

soil potential

the ability of soil to support plant growth, either natural vegetation or crops; also, soil potential as a medium or substrate for construction or landscape.

Storm water runoff

water not absorbed by the ground, taken up by plant or animals, or retained in storage which literally runs off the land surface into streams, ponds, and wetlands.

statutory river segment

NH Rivers Management & Protection Act establishes four descriptive categories for segments of rivers enrolled in the program based on the density of development near the river: natural, rural, rural/community, and community.

steep slopes

hillsides with a slope greater than 15%; steep slopes impose special engineering or cost requirements on construction and water management.

storm water

surface water accumulating from rain or snow melt.

storm water management

collection, diversion, conveyance, retention, and discharge of storm water; management implies measures to prevent sedimentation, non-point source pollution, flooding, and erosion.

subdivision

division of one property into two or more properties by legally recording a change on property boundaries with the county registry of deeds; local standards for lot dimensions and other characteristics of the land may affect the possibilities for subdivision.

Glossary

surface water

any water existing on the land surface, e.g. puddles, ponds, wetlands, streams, etc.; also includes rain and snow melt spread over the land surface.

timber harvest

cutting and removal of trees from land for a domestic or commercial source of lumber, fuel, or other wood fiber use.

upland

land not associated with lakes, ponds, streams, or wetlands.

waste water

any water after use in domestic or industrial processes.

watershed

land area from which all surface water runoff drains at a single place; a watershed is the land area upstream from any point on a stream or drainage channel; boundaries of watersheds are determined by topography under natural conditions, but can be altered by engineering in developed areas with storm sewers; typically discussed for rivers (a.k.a. river basins), large streams, lakes, and ponds.

wetland

an area where the ecology is defined by the soil being saturated with water for at least part of each year; wetlands may also be adjacent to surface waters; types of wetlands include: marshes, bogs, fens, wooded swamps, and ephemeral pools.

zoning (ordinance)

local regulations controlling at least the kinds and densities (lot size and shape) of land uses allowed within a municipality.

zoning district

land area for which the permitted kinds and densities of land uses are established by local zoning ordinance; any municipality may have one or more use districts.

River Management Plan

- Introduction
- Washington - Gilsum
- Gilsum - Keene
- Keene
- Keene - Winchester
- Winchester - Hinsdale
- Hinsdale

Introduction

About the Corridor Management Plan

This Plan was prepared in accordance with the New Hampshire Rivers Management and Protection Act (RSA 483:10). The Act establishes a program by which rivers or portions of rivers may be nominated by the communities sharing the river to the New Hampshire Legislature for enrollment in the protection program. The "protection" comprises enforcement of minimum instream flow volumes by the New Hampshire Department of Environmental Services and the establishment of a Local River Advisory Committee (LAC). The LAC is enabled to develop a river corridor management plan and review environmental permit applications for activities within the river corridor. The definition of the river corridor recommended by statute is the river channel and land within 1,320 feet (1/4 mile) or the landward extent of the 100-year floodplain, which ever is farther from the river bank. However, the LAC and river communities may otherwise establish boundaries as seen fit.

The Ashuelot LAC recognizes that the Ashuelot River and its riparian lands are valued by the river communities for many different reasons. Each reason is equally valid and important to its respective supporters. At times conflicts arise between goals and priorities for use of the river corridor by the community at-large, private property owners, commercial interests, and state and local regulatory powers. **The LAC prepared this plan to protect the river and riparian land for ecological and social values.** Ecological values include biological diversity and unique plant and animal habitat. Social values include recreation, scenic areas, aquifers for drinking water supply, flood water storage, river impoundments for hydropower, and developable land area. It is in this politically sensitive arena that the LAC developed recommendations for corridor protection that the river communities can support: to provide for competing needs without sacrificing river corridor protection to political compromise.

The purposes of this Corridor Management Plan are to:

1) document the condition of natural resources within the river corridor,

2) document the condition and trends in development and resource use within the river corridor,

3) identify threats to the quality (and even the continued presence) of those resources,

4) identify conflicts of resource protection and development within and between the river communities,

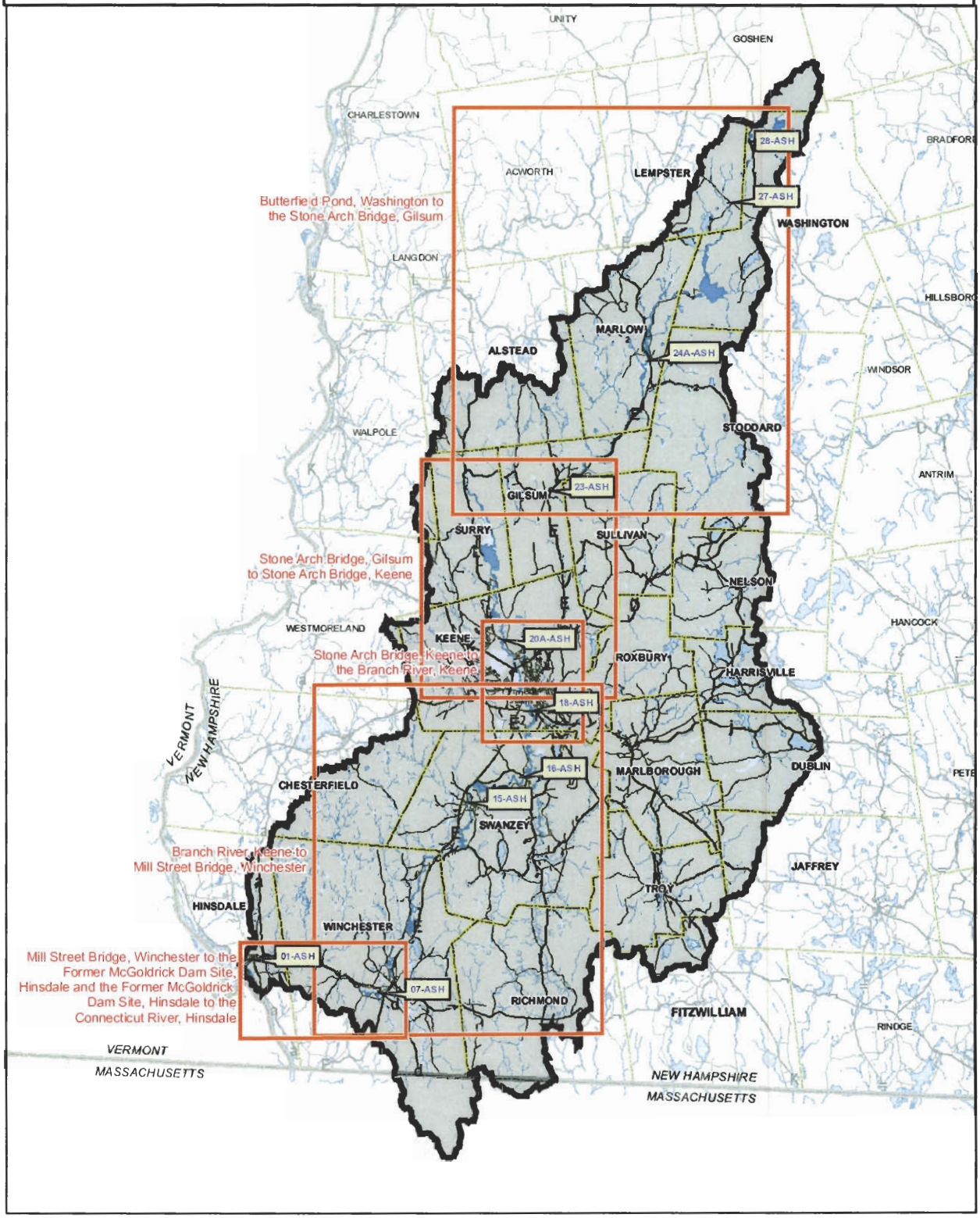
5) present recommendations to the communities that share the corridor for measures to ensure the conservation of natural resources and appropriate development within the river corridor,

6) provide the LAC with a context (technical and policy) for the review of permit applications within the corridor, and

7) protect the defining characteristics of the statutory river segments as established in the 1992 Ashuelot nomination document.

Ashuelot River Corridor Management Plan, 2006 Update

Overview Map



SWRPC

Not intended for site specific work

Ashuelot River
Town Boundaries
State Roads
Local Roads

Water Quality Monitoring Site
Map Areas
Ashuelot River Watershed
Stream or River
Lake or Pond

0 3 6
Miles

Y:/Projects2006/Ashuelot/RCMP_Overview.mxd

Summary of Issues

For the purpose of this Plan, the Ashuelot River begins at the outlet of Butterfield Pond in Washington, NH. Butterfield Pond is the fourth in a series of ponds that are the source of the River in the highlands near Mount Sunapee. North, Mill, May, and Butterfield Ponds are at the heart of 9,000-acre Pillsbury State Park which is in turn in the midst of vast tracts of undeveloped land. Much of the Ashuelot Corridor in the upper reach through the towns of Washington, Lempster, Marlow, and Gilsum is undeveloped. Scattered homes and public roads are the prevailing types of development. Residential development here is almost equally apportioned between permanent residences and camps or cottages.

Development is intensifying on the shores of Ashuelot Pond and Village Pond. Most of this upper reach of the Ashuelot is designated as natural or rural, with community designations in the villages of Marlow and Gilsum. Timber harvest and sand and gravel mining are common activities in this reach of the Corridor. The corridor land comprises a mosaic of private properties, with each property subject to landowner choice, local land use regulation, and regional economic trend. The natural and rural attributes of the upper reach are accordingly susceptible to change.

There is also growing public and private interest in coordinated land conservation planning and implementation in the upper reaches of the Ashuelot. Conservation Commissions are increasingly conversant in the purposes and means of land conservation and three private land trusts (Monadnock Conservancy, Society for the Protection of NH Forests, and The Nature Conservancy) recognize the unfragmented areas of the Ashuelot River's upper reaches as important opportunities.

River Segment Designations:
Butterfield Pond to Falls above Ashuelot Pond, 5 miles, **Natural**
Falls above Ashuelot Pond to Symondsville Rd., 6.6 miles, **Rural**
Symondsville Rd. to Village Pond Dam, 1.1 miles, **Community**
Village Pond Dam to Blackstock Dam, 6.6 miles, **Rural**
Blackstock Dam to Stone Arch Bridge, 1.1 miles, **Community**

Note: *The Ashuelot LAC finds that since the Ashuelot River watershed surrounding the natural segment is sufficiently confined and the landscape conditions are sufficiently homogeneous, management planning under this plan should extend to the boundaries of the watershed in this segment.*

Management Goals

As is the standard throughout the River, segment designations provide the underlying management criteria. There are few site-specific threats to the Corridor's resources in this upper reach. Management goals here include:

- protection or enhancement of the good-to-excellent water quality;
- conservation of wild plant and animal habitat;
- provision of recreational access to land and water;
- soil and other resource conservation practices in timber and sand and gravel extraction activities; and
- preservation/conservation of historic features including mill sites, the Stone Arch Bridge, and character of the Gilsum and Marlow villages.

Water Quality

The water quality in the upper reach of the Ashuelot River is very good, but threats exist today and may be compounded in the future. Protection of an intact, forested **riparian buffer** and/or riparian wetlands will protect the river water from sedimentation, nutrient enrichment, and over-heating in summer sun as well as slowing the flow of seasonal or storm floodwaters. Incorporating standards to restrict the removal of soil, forbs, shrubs, and trees from river banks in subdivision and site plan review regulations is recommended. Town government and industry associations can make available guidance material and technical assistance for the implementation of Best Management Practices (BMPs) to **prevent soil erosion** during any alteration of terrain activity (e.g. logging, sand & gravel mining, road building, private property improvement, new site development). Likewise, **storm water management** to prevent pollution (sediment, pathogens, metals, chemicals, and nutrients) in Ashuelot Pond and in village areas (Gilsum and Marlow) will be a substantial safeguard of river water quality. Local officials and landowner associations should monitor septic systems to **prevent pollution from system failure**. Septic pollution (nutrients, pathogens, and household chemicals) is a particular concern on the shores of Ashuelot, Long, and Sand Ponds and in the village areas of Marlow and Gilsum - places where the long history of dense residential development can harbor substandard, out-lived, or over-burdened systems. Surveillance for septic system failure and a policy for prompt corrective action is recommended for Boards of Selectmen. Local adoption of the land use standards prescribed in the **NH Shoreland Protection Act** should be considered by all municipalities on the upper reach. The UNH Cooperative Extension Service and NH DES provide guidance on this matter.

Currently, the Town of Washington is exploring the creation of a Watershed Protection Overlay Zoning District to manage construction and activities within the Ashuelot Pond watershed and the upper reaches of the river in the hopes of improving water quality. Potential provisions of the district include regulating the location of junk cars and petroleum storage, and a mandatory three-year inspection and cleanout of all septic systems including recording those inspections and cleanouts with the town.

Natural Areas

Protecting natural areas that will provide refuge for the region's indigenous plants and animals is a challenge given the pattern of private property ownership. A **land conservation strategy** is required. A successful strategy will include cooperation among town governments, conservation organizations, scientific academia, and private landowners. The strategy will enable participants to identify important lands for inclusion in a network of lands protected from development. The entire upper reach has opportunity and need for land conservation, with many publicly owned or otherwise encumbered properties already in place. Land conservation is not an alternative to development and economic prosperity. It is part of a comprehensive plan to ensure a hospitable future. Conservation lands can also provide recreational opportunity and be part of local tourism development. Nearly all of the corridor's undeveloped, sparsely developed and agricultural lands are considered desirable for protection due to the high habitat value of riparian forests and wetlands. Local Conservation Commissions, local sportsman clubs, and organizations such as the Society for Protection of New Hampshire Forests, the Harris Center for Conservation Education, The Nature Conservancy, and the Monadnock Conservancy should be brought together for this (Appendix 7.).

Historic Resources

Like most of New England, it is difficult to throw a stone in the upper reach corridor without hitting something historic. Nonetheless, the Ashuelot LAC recommends focused stewardship efforts for several specific sites and areas. The upper reach has several **abandoned mill sites and dams**: between Mill and May Ponds in Pillsbury State Park, south of the Lempster-Washington Rd, the dam at Symondsville Rd sawmill, the dam for the Hodgeman's rake factory at Cohoos Pond, Marlow Village Pond hydroelectric dam, the Blackstock dam, and peg shop ruins above the Gilsum Gorge. Other significant historic features include **Gilsum Stone Arch Bridge** and **Jones Hall in Marlow** - both on the New Hampshire Historic Register. The historic settlement patterns and architecture of the **Gilsum and Marlow villages** also contribute to the character of this reach. Local government is encouraged to cooperate with private and public interests to ensure protection of these historic resources, so that future development does not obliterate these links with the past. Steps can be taken to register historic features with local, state, or national historic preservation agencies. A key to preservation is stewardship of the resource - understanding its value and protecting those values everyday. Preservation does not preclude development, but ensuring the continuation of historic features will enrich development. Documenting the meaning of historic features is an important step to making them part of everyday life. Historic sites or areas can be identified in zoning and subdivision and site plan review regulations as **special use districts**.

Economic Resources

Zoning use districts should allow continuation of timber harvest and sand and gravel mining while also responding to possible tourism values. Zoning considerations should include preserving forested hilltops, identification of scenic views, encouragement of development compatible with scenic value, and allowing for tourist support businesses. Land conservation activity can also preserve timber, maple sap, and tourism opportunities. Tourism is an industry which can provide high local returns and help a rural area like the upper Ashuelot corridor make the most of what it has. Local Master Plans should make a special effort to identify the attributes of the River Corridor, which will support tourism development.

Sand and gravel are abundant resources in the upper reaches and throughout the Ashuelot's watershed. Local enforcement of permitting requirements and Best Management Practices for sand and gravel excavation can mitigate or avoid negative impacts of extraction on the Corridor's other resources and character.

Public Access & Recreation

Public access to undeveloped land and to the river itself is a valuable amenity in the upper Ashuelot corridor. It is essential that the needs of all parties involved be understood and respected. **Public education about land stewardship, responsible behavior in the outdoors on public or private land (including legal requirements), and places where access is permitted is essential to ensuring continued access to public and private lands.** Providing information to landowners is likewise important. In general, any activity that can ensure responsible behavior of the public and improve relations between the public and private landowners will be resources well spent. Providing public access to the river or corridor lands by way of trails or roadside access should also be part of the land conservation strategy.

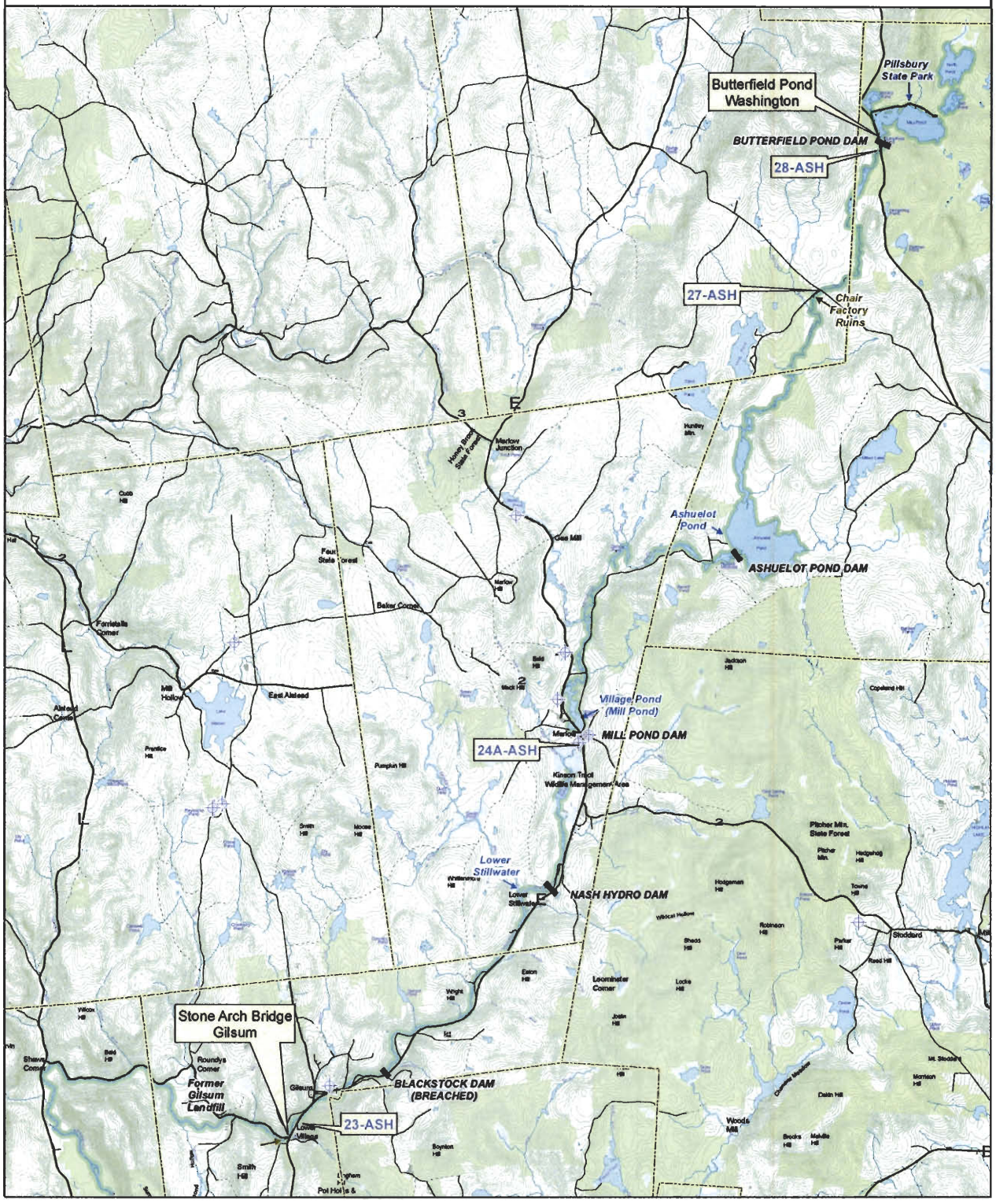
In 2006, the NH DES conducted a study of the impacts of periodic draw-downs of Ashuelot Pond regarding the aquatic plant and animal community. The purpose of the project is to develop a recommended draw-down regimen that will meet the goals of weed control and flood control while avoiding or minimizing 1) negative impacts on water quality and native species and 2) opportunities for the establishment or propagation of invasive, non-native aquatic and riparian species.

Site/Issue Specific Analysis and Recommendations

- Continue to protect forested riparian buffer and/or riparian wetlands
- Prevent pollution from septic system failure
- Protect indigenous plants and animals through a land conservation strategy
- Focus stewardship efforts for abandoned mill sites and dams
- Continue timber harvest and sand and gravel mining while also responding to possible tourism values
- Implement public education about land stewardship, responsible behavior in the outdoors on public or private land and places where access is permitted
- Develop a draw-down regimen that will meet the goals of weed and flood control

Ashuelot River Corridor Management Plan, 2006 Update

Butterfield Pond, Washington to the Stone Arch Bridge, Gilsum



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Not intended for site specific work

Ashuelot River
Town Boundary
Elevation Contour 20 Foot DEM

Roads and Highways

State Road
Local Road
Not Maintained
Roadside Canoe Access
Historic Feature

Water Quality Monitoring Site
Public Water Supply Source
Dam
Stream or River
Lake or Pond
Wetland
Conservation Land
Other Public or other Institutional Land
Developed Area (NH Granit 2001 Land Cover Data)

N W E S

0 0.5 1
Miles

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Summary of Issues

This 14.5 mile reach of the Ashuelot, bounded on either end by historic stone arch bridges, is designated as **rural**. The River Corridor varies from a precipitous gorge in highland forest at the Gilsum Stone Arch Bridge through a narrow steep-sloped valley in Surry to a broad flat plain through farm fields and floodplain forest in Keene. The river transitions from a high energy upland stream of rapids and riffles coursing downhill through boulders, stones, and forest to a gentle meandering river flowing through backyards, floodplain forest, and farm fields toward the Connecticut River. Likewise, the management issues for the Corridor transition here. Issues of the upper reaches above Keene are dominated by concerns about the impacts of resource extraction (timber, sand & gravel), preservation of unfragmented forest tracts, and protection of corridor resources from potential development. Beginning in Keene, threats from pollution, impairment of the floodway, and loss (absence) of riparian forest come to the fore as management issues. The special issue of endangered species habitat arises in Keene also, where a sensitive population of dwarf wedgemussels inhabits a site in the Ashuelot River bed. The largest recorded population of the state endangered small-footed bats in New Hampshire resides within the riprap of the Surry Mt. Dam. There are other local concerns in this reach, including the abandoned Gilsum town dump, Surry Mt. flood control dam and reservoir (with considerable federal land holdings), several miles of state road adjacent to the river banks, and nearly a mile of river meandering through a golf course in Keene. The results of the phase two analysis of the Gilsum town dump in 2005 showed the quality to be very good. The Town is making slow but steady progress in this remediation but it is still a concern. Water quality above the Surry Mt. Dam is considered very good. The flood control reservoir has uncertain impacts on downstream water quality and habitat. The suburban development arising in Keene introduces non-point pollution.

Management Goals

As is standard throughout the River Corridor, segment designations provide the underlying management criteria. There are several site-specific threats and issues in this reach. Management goals include:

- protect good-to-excellent water quality;
- protect public access for instream recreation (e.g. canoeing, kayaking, fishing, swimming);
- maintain or rehabilitate forested riparian buffer;
- protect high value instream and riparian plant and animal habitats;
- reduce NPS threats: turf management (nutrients, pesticides, herbicides), storm water runoff, soil erosion (sediment and nutrients), and road salt impacts;
- encourage steep slope management to prevent erosion from logging and at site development;
- improve fisheries for sport fishing;
- encourage communication between Ashuelot LAC and NH Fish and Game; and
- continue land conservation on Surry Mountain.

Water Quality

Ashuelot River water quality is considered to be very good between the Stone Arch Bridge in Gilsum and the Surry Mt. reservoir. The use of **road salt** on the River Road is a potential threat to water quality, though tests in 2001 and 2002 did not show elevated levels of contaminants. Furthermore, there is not yet available a definitive explanation of the ecological effects of road salt on stream water. There is concern that the water quality of the Ashuelot is adversely affected by eutrophication of the **Surry Mt. reservoir**. Pollution of ground and river water with chemical fertilizers, herbicides and pesticides used for **turf management** on the Bretwood golf course is another water quality concern. This reach also hosts an increased level of sensitivity for ground water protection with significant stratified drift aquifers in the Keene valley floor beginning below the Surry Mt. dam. Keene has enacted a wellhead protection program for its municipal well near the Cheshire Turnpike Stone Arch Bridge.

Public Access

Currently, there is informal public access to the river and riparian lands throughout much of this reach. The principal exception is Bretwood golf course. Few landowners feel compelled to post their land against public use. Access to the river for canoeing and kayaking, fishing, trapping, and hunting is enjoyed by residents and visitors. **Public education** to build awareness among river users of private landowner rights and user responsibilities that come with the privilege of access could ensure the continuance of this informal arrangement. Provision of **publicly-owned access areas** by municipal or state government is also recommended. Providing safe convenient parking as well as access rights-of-way to the river for river users could be provided by state and local government as with great ponds today. Note: Surry Mt. reservoir and its surrounding federal lands are a major public lands resource in this reach of the Ashuelot providing recreation and plant and animal habitat.

Riparian Buffer

Suburbanization and the Bretwood golf course have eliminated much of the trees and shrubs from the river banks below the Surry Mt. dam. **River bank deforestation** has the effects of riparian and instream habitat destruction and loss of runoff and floodwater moderation. Development that causes river bank deforestation usually precludes re-establishment of the riparian habitats, but, river banks can be managed to restore the shading effect of tree canopies on stream water in ways that are compatible with most suburban and recreational land uses. Private land owners are encouraged to plant and manage native trees and shrubs to shade the stream. The NH DOT is similarly encouraged to replant areas along the river following construction or road work. Standards prohibiting loss of riparian trees and shrubs can be included in zoning and site plan regulations.

Instream and Riparian Habitat

Instream habitat undergoes natural changes as the river levels and slows as it approaches Keene from the north. But the **Surry Mt. Reservoir management** has a profound effect on the hydrology and on the natural seasonal cycle of change and stability in the streambed downstream from the dam. Reservoir management for flood control purposes must not obliterate the ecology of downstream habitat.

In 2005, the U.S. Army Corps of Engineers and U.S. Fish & Wildlife Service formalized a flow management regimen for the Ashuelot downstream of Surry Mountain Reservoir. Protecting and restoring the endangered dwarf wedge mussel populations in Keene and Swanzey is the primary goal of the regimen. The Fish & Wildlife Service's aquatic base flow model for a healthy stream was adapted in an effort to mimic the natural flow most suitable for the dwarf wedge mussel. Monitoring dwarf wedge mussel response to the flow management began in 2005.

Riparian habitat upstream from the Surry village area is essentially upland forest growing on the stream bank. There are areas with small wetland inclusions and sand bars. At Surry Village and Surry Mt. reservoir the landscape changes: riparian lands begin to support floodplain habitats which are typified by red osier, alder , silver maple, and cottonwood growing on sandy soils that are subject to high water table and frequent flooding. Planning for natural area conservation and **greenway planning** can link Surry Mt. dam public lands with City of Keene park land.

The US Army Corps of Engineers is currently trying to eradicate the Surry Mt. Dam area from invasive species such as Knotweed however periodic spraying and mowing have not resulted in a substantial decline of the population. Public awareness of invasive species that threaten native instream and native habitats is recommended.

Agricultural Land

The landscape and soils of the Keene valley floor (below the Surry Mt. dam) can support tillage crops, e.g. corn, fruits and vegetables, at a scale heretofore not possible - although the sandy loams are not prime agricultural soils. The corridor from Keene south has a history of agricultural development but now there are few active farms tilling only a fraction of the former farm land. Suburban and commercial development has displaced agriculture and late twentieth century economics of farming do not support small scale livestock or crop farming in New England. There is concern that loss of agricultural potential by development of farm land may incur a heavy price in the years to come. Preservation of agricultural potential can be accomplished by preserving unfragmented farm land for agricultural production or as natural areas. Local zoning can set aside conservation areas and encourage cluster development to prevent fragmentation of fallow farm land. Local and regional economic development efforts can assist local farmers maximize profits from local produce with the development of value-added products (such as preserves, sauces, and maple sugar).

Nonpoint Pollution Sources

The rise of suburban development and increased density of the road network and other paved areas increases the impact of non-point source pollution (NPS) in this reach. Gasoline and other petrochemicals spilled from motor vehicles, particles of metal and other chemicals on roadways and parking lots, and the use of fertilizers and other chemicals for suburban lawn care endanger water quality and aquatic habitats. **Public education** targeting residents, business owners, and government officials about management practices for storm water management and the use of lawn care and petroleum products is recommended to minimize NPS impacts. **Riparian zoning setbacks** from the river for application of lawn care chemicals and **site plan standards** for storm water management systems and retention of trees and shrubs on the river bank can reduce the transport of NPS pollutants to river water. Setbacks and land conservation initiates surrounding tributaries and feeder streams can also protect the quality of the water

in the main stem. The corridor soils downstream from the Surry Mt. dam tend to be well drained sandy soils subject to seasonal flooding, with the water table near the surface. Water percolates downward quickly through these soils. Accordingly, there is a high potential for ground water pollution by substandard, over-taxed, or otherwise deficient septic systems. **Surveillance for septic system failure** by residents and local officials is recommended, as is a local government policy for quick remediation of known problems.

Steep Slopes

Development on hillsides with a slope greater than 15% can lead to soil erosion and increased storm runoff. The latter also means decreased infiltration of water to ground water. Increased runoff and decreased infiltration lead to impoverishment of ground water supplies for late summer and increase in flood waters during snow melt or rain storms. **Development on steep slopes is to be discouraged** via zoning and site plan standards unless extraordinary precautions to avoid erosion and runoff problems can be assured. Driveways constructed with a steep slope can also increase runoff into nearby tributaries or the Ashuelot. Towns are encouraged to address this issue in site plan standards or a specific ordinance. Best management practices for prevention of erosion and sedimentation should always be part of site plan standards.

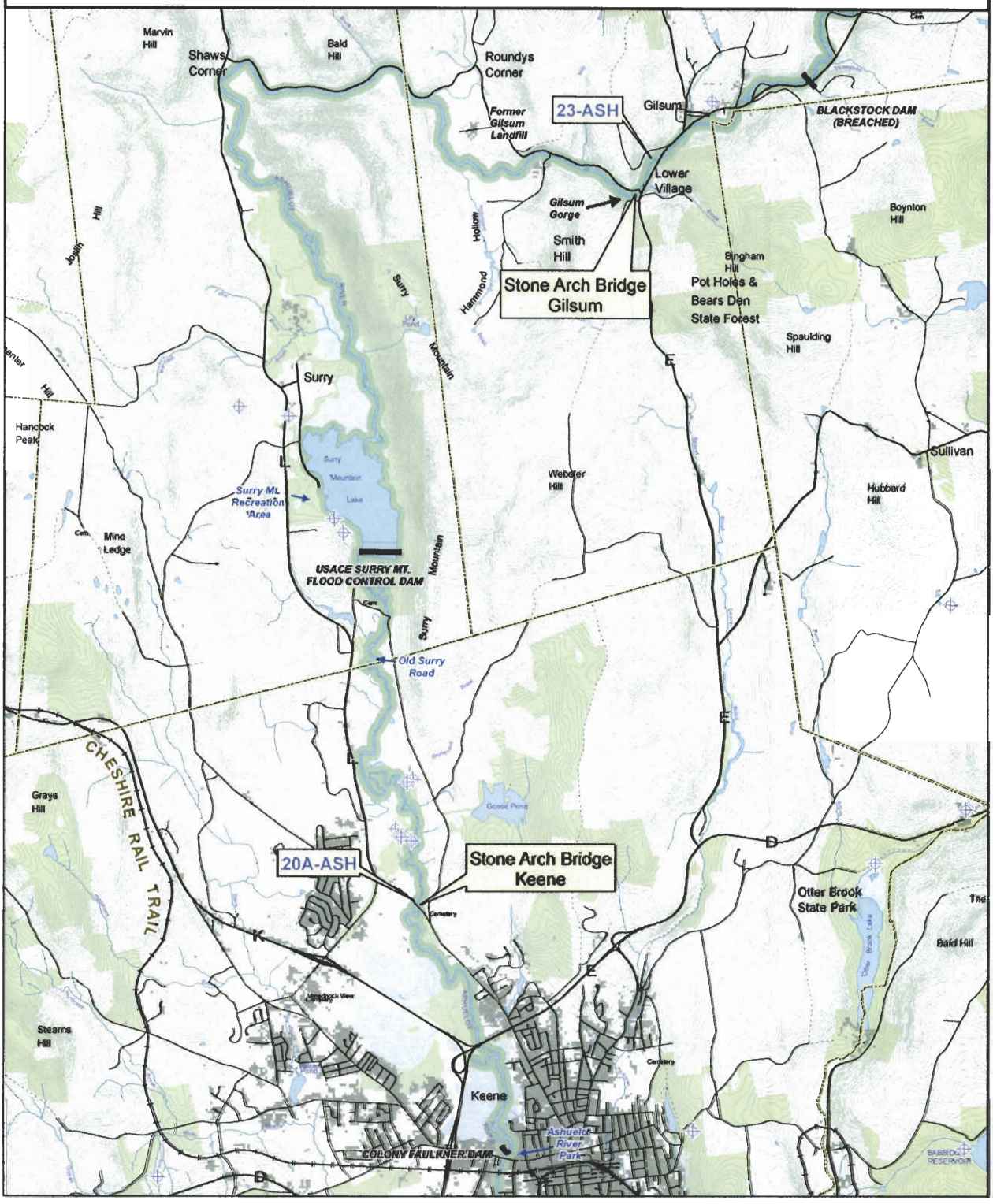
Site/Issue Specific Analysis and Recommendations

- Minimize reservoir and downstream water quality impacts of Surry Mt. reservoir
- Minimize down stream hydrologic impacts of Surry Mt. reservoir
- Protect scenic character of River Road
- Preserve natural amenities of the Gilsum Gorge
- Manage public access to Gilsum Gorge
- Integrate US Army Corps of Engineers Surry Mt. flood area land management goals with local and corridor wide goals (regarding plant and animal habitat and agricultural land)
- Integrate off-corridor land management goals re: Surry Mountain ridge and Greater Goose Pond area with corridor goals
- Understand and manage pollution threat posed by the old Gilsum dump
- Support the US Fish &Wildlife Service dwarf wedgemussel rehabilitation plan
- Support the Keene Wellhead Protection Program and aquifer protection measures

- Implement public education to control or eliminate suburban NPS pollution; including the proper use and disposal of petroleum products; household chemicals, chemicals for lawn and golf course turf management, and road salt
- Provide for public access throughout the reach
- Promote awareness of timber harvest Best Management Practices and statutes in local government and industry
- Increase monitoring of timber practices and enforce all applicable rules and regulations.
- Restore riparian forest and shade in Bretwood golf course
- Concentrate on a wider approach to river protection including the watersheds of all feeder streams and tributaries.
- Continued support of US Army Corps of Engineers (USACE) flow regulation plan
- Integrate Surry's wellhead protection program (upcoming) with protection of the Ashuelot River
- Make aware the USACE of current river issues.

Ashuelot River Corridor Management Plan, 2006 Update

Stone Arch Bridge, Gilsum to Stone Arch Bridge, Keene



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Digital base information provided by the New Hampshire Geographically Referenced Analysis and Information Transfer System (GRANIT)

Not intended for site specific work

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- Ashuelot River
- Town Boundary
- Elevation Contour 20 Foot DEM

Roads and Highways

- State Road
- Local Road
- Not Maintained
- Rail Trail
- Roadside Canoe Access

- Water Quality Monitoring Site
- Public Water Supply Source
- Dam
- Stream or River
- Lake or Pond
- Wetland
- Conservation Land
- Other Public or other Institutional Land
- Developed Area (NH Granit 2001 Land Cover Data)

N W E S

0 0.5 Miles

Summary of Issues

This **four-mile Community** segment is unique in the corridor for the intensity of urban development on its river banks. Urban features that affect River Corridor resources include:

- high percentage of land area covered by asphalt, concrete, and buildings;
- conveyance of runoff via storm sewers;
- industrial contamination sites;
- dense street and highway network with high traffic volumes;
- complex and aged sanitary sewer system;
- riparian recreation areas;
- dense development on land over extensive stratified drift;
- riparian natural areas (parks); and
- high population density.

These features are the bases for a suite of threats, damages, and demands that call for effective community action to protect Keene's Ashuelot River Corridor resources. The types of issues are not unique to this segment, but the level of threats, potential for loss, and level of competition between demands are greater here than elsewhere on the Ashuelot.

Brooks and storm runoff in Keene have been managed for hydraulic efficiency since the City's early days. Water is collected and channeled to the Ashuelot by pavement, rooftops, drains, ditches, culverts, and walled/diked stream channels to move as much water away from development as fast as possible and maximize the amount of land available for development. There are some negative effects associated with this approach, especially since Keene is situated on an area characterized by its hydrology: floodplain formerly dominated by wetlands at the confluence of many brooks. The negative effects of this management approach include impoverishment of ground water (by loss of opportunity for water to infiltrate into the soil in the City area), increased downstream flood hazard (by loss of flood water storage area), increased downstream erosion hazard (by increased discharge volumes and force in the River), and increased sediment load in the River water.

Non-point source (NPS) pollution, impoverishment of ground water, and increased flood hazard are direct consequences of impervious surfaces, channelization of runoff in storm sewers and ditches, and accidental or neglectful contamination of soil and water with pollutants from motor vehicles, lawn care, industrial processes, and sewage.

There are several areas in the City where former municipal or industrial practices and accidents left extensive soil contamination. These pollution sites damage the environment and economy. Some of these sites are known but not well defined in terms of identities of contaminants or patterns of movement through the soil and ground water. Known contamination sites include underground gasoline spills, abandoned back lot industrial waste dumps, and former municipal dumps. These sites are of great concern to City government, residents, and conservationists. Former waste management practices, e.g. direct discharge of sewage and industrial waste into the River, also create the problem of contaminants "stored" in the sediments of the Riverbed and the possible persistence of some chemicals in plant and animal tissue.

Stone Arch Bridge, Keene - Confluence of the Branch, Keene

The City of Keene, private property owners and developers continue to participate on the U.S. EPA Brownfields Program. The former Cheshire Rail Road corridor east of Main Street and the Emerald Street corridor between Main Street and the Ashuelot River are the City's target areas for Brownfields assessment and remediation. The Emerald Street corridor includes subsurface contamination including hydrocarbons from accidental gasoline releases and dumping of coal gasification wastes, and heavy metals possibly from former industries.

The River has recently enjoyed a renewed appreciation as a City asset. During the last 25 years the River in Keene has become a stream of cleaner water bordered by park land and natural areas. A typical paradox has developed concurrently: increased popularity and appreciation of natural areas can lead to destruction of the various attributes, which make it popular by overuse. Walking, mountain biking, fishing, and canoeing throughout the Ashuelot River Park and Tenant Swamp areas have grown dramatically in late years. The combination of a high number of people respectfully using these areas and occasional inappropriate and damaging misuses is taking its toll on the appearance and character of the forests and river banks.

The several hundred acres of Tenant Swamp and adjacent public lands are not the only valuable habitats in this segment. The River bank through most of Keene hosts riparian and aquatic plants and animals. Beaver, muskrats, mink, fox, herons, waterfowl, partridge, shorebirds, myriad songbirds, and even deer can be seen regularly in the corridor north of West St. and south of NH 101. These "natural areas" are a great asset adjacent to downtown.

A new instream habitat appears in this segment also: flat water. Upstream from the Stone Arch Bridge in Keene, River habitats are mostly cold fast moving water riffles over gravel and stones and rapids coursing through boulders with interspersed pools. But here the nearly flat valley floor imposes a very low gradient and the river begins to meander, flow rates slow, bottom sediments become finer and deeper (sand, silt, and organic debris - "mucky"). Attendant changes in water characteristics include increased temperature, lowered dissolved oxygen and increased turbidity. There is a distinct qualitative change in the character of the Ashuelot River at the head of this segment which typifies much of the remainder of the River. The River is also impounded in Keene by the former Colony Mill Pond dam (the pond was reduced to the river channel by filling for development). The impoundment extends about three miles upstream from West St. River habitats include deeper water, lower oxygen content, and much more emergent vegetation. Red fin pickerel, creek chub, fall fish, perch, and sun fish are abundant here with pickerel weed beds, emergent grasses, and silky dogwood at the river's edge. The slower water coincides with increased sediment load entering the river from Keene's storm water runoff - contributing to higher turbidity and the accumulation of contaminants in River bottom sediments. NPS pollution prevention is essential to the protection of public health and instream habitats. Chemicals and metals can be toxic to humans, fish, wildlife, and plants. Sediment can obliterate stream bed habitats of plants, fish and other animals. Nutrients promote luxuriant plant growth which in turn consumes the available dissolved oxygen in the water when it decomposes - leaving the river impoverished for oxygen and possibly uninhabitable by native animals.

An extensive array of athletic fields for Keene State College begins in this segment (and continues in the next). The Keene State campus is a major riparian land use in Keene. The River adds to the park-like atmosphere of the college campus and is also susceptible to turf management and parking area runoff contaminants. Keene State's Science Division uses the River as a local environmental studies field laboratory - bringing important research and advocacy capabilities to River protection issues.

The abandoned, now state-owned Ashuelot rail line begins in Keene and runs the river banks from Keene to downtown Hinsdale. This corridor is currently under development as a multiple use public trail, although it has been used informally for many years for walking, biking, and ATVs. State and local involvement facilitated the replacement of several defunct railroad bridges crossing the River to provide a continuous trail from Keene to Hinsdale on this historic rail line. Other historic features include the industrial and residential development heritage throughout the corridor in Keene.

The River Corridor in Keene is underlain with substantial sand and gravel aquifers, as is the entire Keene valley. Protecting this valuable resource and existing municipal wells is a priority in the City's land use and infrastructure planning. Keene has a Wellhead Protection Program in place for the municipal wells, including one near the Stone Arch Bridge.

Management Goals

- provide public access for instream and riparian recreation (e.g. canoeing, kayaking, fishing, swimming, walking, and biking) outside of City-owned lands;
- manage public access within City-owned park land;
- maintain or rehabilitate forested riparian buffer;
- reduce NPS threats: turf management (nutrients, pesticides, herbicides), storm water runoff and soil erosion (sediment, nutrients, sewage), and road salt impacts;
- describe the extent and nature of known subsurface contamination sites and expedite state and City clean-up programs;
- locate and repair leaks as may exist in the municipal sewer lines;
- preserve undeveloped floodplain areas;
- continue development and protection of Keene area riparian public land; and
- integrate corridor management and land conservation (permanent protection) with existing Keene park land in and near the corridor, e.g. Goose Pond and Ashuelot River Park
- increase upstream signage alerting paddlers to the dam on the Ashuelot River in Ashuelot River Park and the dam on The Branch downstream of the Cheshire Stone Arch Bridge.

Public Access

There are hundreds of acres of City-owned public land in this segment. Availability of public access for instream and riparian recreation (e.g. canoeing, kayaking, fishing, swimming, walking, and biking) is a problem. Outside of the City-owned land there is limited informal access. In the City's Ashuelot River Park careful management of public use is required to ensure that growing popularity does not compromise natural and cultural resource values. The Keene Conservation Commission, and private non-profit organizations: Pathways for Keene, Ashuelot Valley Environmental Observatory. and Friends of Ashuelot River Park can play essential roles in **public education and community stewardship** activities to minimize attrition of corridor resources by overuse.

Riparian Buffer

The **maintenance** of existing riparian forest and **restoration** of denuded river banks provides water quality, habitat, flood control, and scenic benefits. Riparian forests and wetlands are integral to greenway

planning and habitat protection. Management and acquisition of public lands should proceed with goals for buffers and all attendant benefits as a priority. Corridor management and Keene area **land conservation** should be mutually integrated.

Floodplain

Currently undeveloped floodplain in Keene is a premium asset for Keene and the communities downstream. The City should assertively discourage new development on undeveloped floodplain. Increased density of existing development on floodplain should be prohibited. Storm water management requirements for site development should consider flood mitigation as well as water quality. Protection of natural floodplains not only result in flood mitigation and water quality benefits but also protects unique floodplain forests and wetland habitats.

Water Quality

The water quality in this segment is officially rated as good by the state. However, the river water is subject to suburban and urban **non-point source pollution** (NPS): storm water runoff which introduces bacteria, nutrients, pesticides, herbicides, gasoline and other petrochemicals, and sediments (which may include heavy metals). The non-point source pollution threat can be mitigated with appropriate **storm water management** and **turf management** for both private and public properties. Soil erosion is less of a problem in this reach than elsewhere except for the conveyance of sediment-laden water from construction sites via the storm sewer system.

Subsurface Contamination Sites

The industrial heritage of Keene has left an unwanted legacy: subsurface contamination. Former back lot dumping of waste materials and chemicals by local industry and former municipal waste management practices have left several sites of buried pollutants in the corridor. These sites are known to exist but difficult to fully characterize in extent and constituency. Financial and human resources must be applied to the accurate definition of these environmental problems and the **expedient clean-up** of contaminants. Political will to expose and eliminate these problems must be developed locally and at the state level.

Specific Analysis and Recommendations

- Improve storm water management and reduce impervious surfaces associated with existing development

- Ensure appropriate storm water management and minimal impervious surfaces associated with continued expansion in the Krif Road Industrial Park, the Monadnock Market Place, Black Brook Industrial Park, and the Keene Bypass.

- Continued support and funding of Keene's park land and open space development

- Community support for public education regarding stewardship of private and public riparian lands and the River proper, including the new Ashuelot River Park teaching site, Rachel Marshall Outdoor learning Center

- Management of Keene public lands to prevent destruction of resources by overuse or misuse by the public

- Inclusion of Keene State College, Antioch New England, and Keene public schools in corridor land use planning and resource management activities

- Community support for development and maintenance of the Ashuelot Rail Trail

- Determine and eliminate causative factors for the observed high coliform bacteria numbers in Beaver Brook and low oxygen concentration in the River (NOTE: In 2006, the City received a "Watershed Restoration" grant form U.S. EPA to research sources of pollution in the Beaver Brook watsrshed, undertake restoration efforts – including undertaking public education activities to avoid and prevent further pollution.)

- Prohibit further development on Keene area floodplain

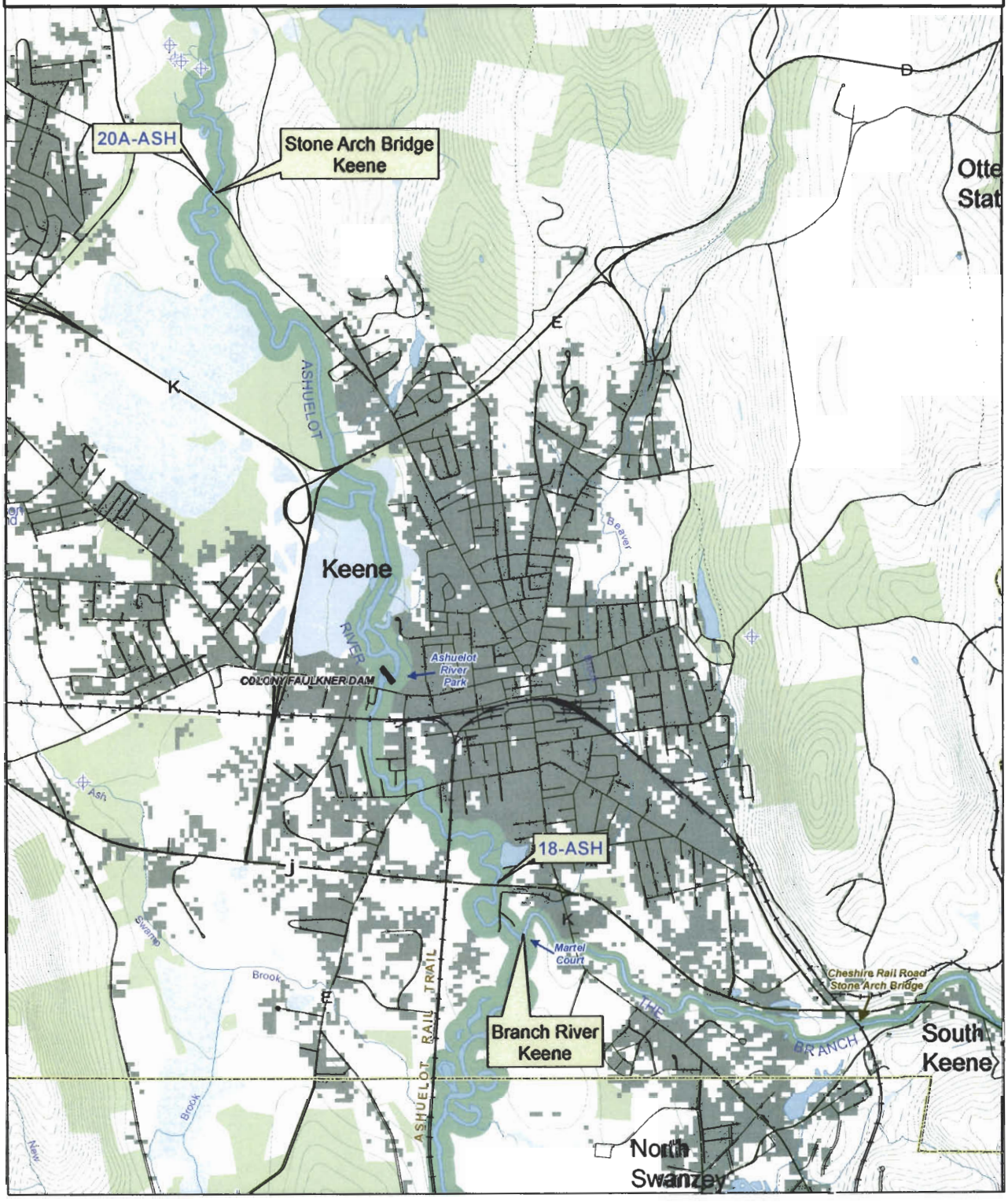
- Support municipal and private activities to remediate gasoline contamination under Emerald Street and the vicinity to the south

- Support municipal and private activities to remediate soil and ground water contamination as may exist in the vicinities of the former canal beneath the Center at Keene/Emerald Street, Keene Public Works property, southwest from Bradco Street, and Keene Landfill west of NH route 12 in Keene near Surry and Westmoreland.

- Promote to the City of Keene's elected government and staff the benefits and importance to the City of supporting annual testing for metals, including lead and copper in the Ashuelot River.

Ashuelot River Corridor Management Plan, 2006 Update

Stone Arch Bridge, Keene to the Branch River, Keene



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Not intended for site specific work

Ashuelot River
Town Boundary
Elevation Contour
20 Foot DEM

Roads and Highways
State Road
Local Road
Not Maintained
Rail Trail
Roadside Canoe Access
Historic Feature

Water Quality Monitoring Site
Public Water Supply Source
Dam
Stream or River
Lake or Pond
Wetland
Conservation Land
Other Public or other Institutional Land
Developed Area
(NH Granit 2001 Land Cover Data)

N
W
E
S

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Miles

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Summary of Issues

This chapter addresses three river segments: a **6.1-mile Rural** segment between the confluence of the Branch River in Keene to the confluence of an unnamed brook at the north edge of West Swanzey village, a **1-mile Community** segment through the West Swanzey Village, and a **9.3-mile Rural** segment from the Denman Thompson Bridge in West Swanzey to the Mill Street Bridge in Winchester.

Both **rural** segments are mostly undeveloped floodplain as the river adopts the extreme meandering path of a mature river on the valley floor. The geomorphology and ecology of the riparian lands here are dominated by the millennial history of meandering and flooding. Access to much of this segment is impaired by its wetlands, thick shrub growth, many small tributaries, and oxbow ponds. These same characteristics make this segment a *de facto* wild area for plants and animals. Mount Cresson is a notable upland feature. Land use is largely residential with several large tracts of hay field and pasture, but again, most of the segment is undeveloped. The Kelly family dairy farm is adjacent to the river near the southerly end of the Winchester segment, and there are several other locations where hay, pasture, or tillage approaches the river banks in Swanzey and Winchester.

Flat water canoeing and kayaking are popular here spring through fall. The Ashuelot Rail Trail runs near the river, crossing it twice - the "Ashuelot Line" is under development as a multi-use trail. The segment has plentiful undisturbed natural scenery visible from local and state roads. Four covered bridges cross the Ashuelot in this from Keene to Winchester: the Cresson, Thompson and Slate bridges in Swanzey and the Coombs Covered Bridge in Winchester just south of the Swanzey town line. The Slate Bridge in the Swanzey village of Westport was destroyed by fire in 1993 and was rebuilt in 2001 with public fundraising. The river courses a short rapid through the ruins of a mill dam adjacent to Westport. NH route 10 runs parallel and quite near the river for several miles of the southerly rural segment and local roads closely parallel the river bank throughout all three segments. The River also receives discharge from two municipal wastewater treatment facilities in Swanzey: the City of Keene discharges effluent into the Ashuelot upstream of the Cresson Bridge and West Swanzey's treatment plant discharges south of the Denman Thompson Bridge.

West Swanzey is a village with agricultural and industrial beginnings. Today there are a number of businesses and about 400 homes in the village. Most of the households there are served by municipal sewer. The Homestead Woolen Mills dam and the Thompson Covered Bridge are significant cultural features associated with the River in West Swanzey. NH DES has mandated that the privately owned Homestead Woolen Mills dam be either improved or breached. A comprehensive feasibility study was completed by NH DES in 2005 to identify alternatives regarding: attaining dam safety, whether through dam removal or dam repair; ensuring the stability of the Thompson Covered Bridge (1832) and the historic integrity of West Swanzey Village and the Homestead Woolen Mills; and restoring fish movement past the dam, whether through dam removal or installation of a fish passage system. March 2006 Town Meeting voted to not purchase the dam. Planning began in 2006 to remove the dam while ensuring the structural integrity of the Thompson Bridge.

The Town of Winchester zoning regulations restrict construction of structures within the 100-year floodplain. The segment of the River located in Winchester is also within the Town's Aquifer Protection District. This overlay district regulates lot sizes and impervious surface area in an effort to minimize storm water runoff and maximize recharge of the aquifer. The Ashuelot Rail Trail in Winchester,

maintained by the Winchester Trail Riders, provides safe and convenient four-season public access within the Corridor.

The following specific issues further characterize this rural segment.

- water quality suffers cumulative effects of sediment and upstream non-point source pollution;
- high bacteria concentrations with increased storm water and high water conditions, and low oxygen concentration under summer low flow conditions;
- phosphorus loading from the Keene waste water treatment plant which adds to the large amounts of nutrients in the river sediment;
- extensive stratified drift aquifers;
- riparian natural areas (undeveloped private land and conservation land including Yale Forest, Dickinson Forest, Mount Cresson, and the Muster property);
- The 2003 Swanzey Master Plan includes the December 2001 Ashuelot River Corridor Management Plan as an appendix. Thoughtful implementation of the land use and other development and conservation goals of the Swanzey Master Plan can support the goals of the Corridor Plan. Swanzey also adopted an Open Space [conservation] Plan in 2004.
- Mitigate or prevent the spread of invasive plant species along the river corridor, particularly Japanese knotweed and purple loosestrife.
- Potential negative effects of brush cutting along Beaver Brook and Ash Swamp Brook.
- development encroaching on scarce agricultural soils and farm landscape;
- potential for undetected effluent of untreated residential sewerage;
- various historic features, including the Cresson, Thompson, and Coombs covered bridges, and the Homestead Woolen Mill site;
- state threatened species: Blue-gray Gnatcatcher (warbler), Sprout muhlenbergia and Long-fruited anemone, and state endangered Wild Sensitive Senna (*Cassia nictitans*), and dwarf wedge mussel (*Alasmidonta heterodon)*.
- paleo-Indian archeological sites and a stone fish weir in the River between Ash Swamp Brook and West Swanzey.
- The confluence of the Branch River nearly doubles the water volume in the Ashuelot River, and the South Branch Ashuelot River is also a significant tributary in terms of water volume. Mirey Brook and it tributary Roaring Brook provide high quality anadromous fish habitat due to hydrography and relatively unfragmented watershed.

There is another condition arising in the northerly rural segment. The River channel is filling with sediment. The low gradient in this segment (i.e. the River is flowing through relatively flat land so the

water flows languidly and does not have the power to move material), the high sediment load from upstream storm water runoff, and attenuation of annual runoff peaks by Surry Dam flood control management (i.e. the River does not flood as high in the spring or during other big runoff events, rather, the runoff from upstream is stored in the reservoir and released slowly and not allowed to spill onto the floodplain) is filling the River channel with sediment. Without the flood control structures at Surry Mountain and Otter Brook that protect thousands of homes and businesses and structures and infrastructures valued in the hundreds-of-millions of dollars from flooding, the River would have periods of flooding, especially spring snow melt, when the river water would scour out sediment deposited in the River bed since the last flood and move it downstream or deposit it on the floodplain areas. That has not been happening since those two flood control dams were installed. Sediment washed into the River upstream settles to the bottom in this slow moving water and is not removed. Effects of this situation are several: disruption of river ecosystem: the river water, river bed, and floodplain; reduction in volume of the river channel; and accumulation of pollutants in River bed sediments.

Growing amounts of impervious surfaces upstream and within this segment result in "spikey" runoff episodes: rain water and snowmelt flow directly from roof tops, pavement and storm drains into the River without attenuation by localized flooding of low-lying areas or infiltration to groundwater. This results in higher erosive forces in the River following runoff events, increasing the potential for stream bank erosion in the sandy soils of this segment.

Management Goals

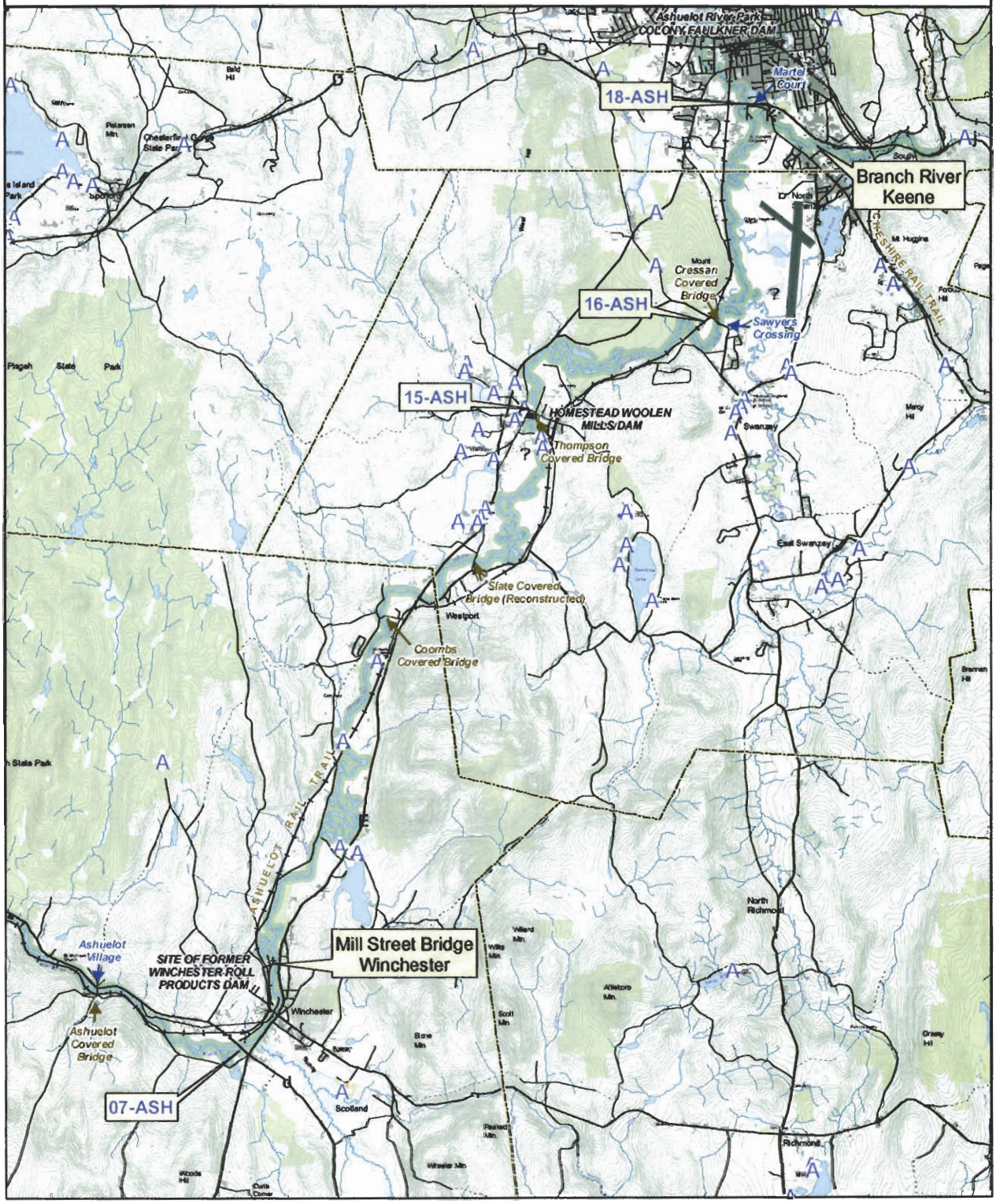
- Reduce nutrient load and chemical pollutants from upstream riparian sources within this segment, and from the Keene and Swanzey waste water treatment plants.
- Reduce sediment load.
- Continue the Volunteer Water Quality Monitoring program from May to September and consider monitoring the presence of metals (Appendix 6).
- Preserve historic and archeological features.
- Collect baseline water quality data before any instream structures are removed from the river.
- Monitor impacts of dam removal regarding flow, including the introduction of invasive species.
- Create formal public access to the River and ensure responsible access to the River and adjacent natural areas.
- Indicate the importance to the City of Keene of annual water testing for metals including lead and copper in river water.

Site/Issue Specific Analysis and Recommendations

- Ensure appropriate storm water management and minimal impervious surfaces associated with existing and future commercial and industrial development on riparian lands
- Continued support of private and municipal land conservation, including cooperation with the efforts of Monadnock Conservancy, Society for the Protection of NH Forests, and The Nature Conservancy (Appendix 7).
- Encourage land conservation in the Yale Forest.
- Encourage community support for public education regarding stewardship of private and public riparian lands and the River proper, including cooperation with the Monadnock Regional School District, Winchester School District, Keene High School and Keene State College
- Monitoring and management of public use of Ashuelot Line Trail to prevent destruction of resources by overuse or misuse by the public
- Inclusion of Monadnock and Winchester School Districts in corridor planning and stewardship activities
- Encourage community support for development and maintenance of the Ashuelot Rail Trail
- Determine and eliminate causative factors for the observed high E. coli counts, nutrient load, and sediment load
- Discourage development on floodplain lands
- Protect intact riparian "natural areas", e.g. oxbow/wetland/floodplain forest systems
- Support efforts by towns to implement regulations to protect water quality such as steep slope ordinances, setback requirements and storm water plans.

Ashuelot River Corridor Management Plan, 2006 Update

Branch River, Keene to Mill Street Bridge, Winchester



Not intended for site specific work

Ashuelot River
Town Boundary
Elevation Contour 20 Foot DEM

Roads and Highways
State Road
Local Road
Not Maintained
Rail Trail
Roadside Canoe Access
Historic Feature

Water Quality Monitoring Site
Public Water Supply Source
Wastewater Treatment Plant
Dam
Stream or River
Lake or Pond
Wetland
Conservation Land
Other Public or other Institutional Land
Developed Area (NH Granit 2001 Land Cover Data)

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Miles

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Summary of Issues

This chapter addresses two classification segments: a **1.2-mile Community** segment through Winchester from the Mill Street bridge south to the NH 119 bridge followed by a **5-mile Rural** segment west from the NH 119 bridge to the dam site formerly owned by McGoldrick Company in Hinsdale.

The Winchester village area is compact and developed immediately on the river bank with several hundred feet of building foundations that are actually at the water's edge. There are several small manufacturing businesses in the village area corridor, also retail businesses and residential apartments. Storm water runoff is an issue here from parking areas and local streets near the river bank. The abandoned AC Lawrence leather tannery has been removed, and with the closing of the Mill Street bridge, redevelopment of the AC Lawrence site is unlikely in the near future. The property has a waste water treatment facility near the river bank just downstream of the Mill Street bridge. The property's soil was treated under the EPA Superfund program for contamination by metals and acids used in the Lawrence tannery. An historic steel truss bridge was recently replaced at Elm Street in the center of the village. Winchester also has a municipal waste water treatment facility at the southern end of the community segment. The Town of Winchester owns a 180-acre parcel of conservation land at Snow Brook. The Winchester Conservation Commission will construct a canoe launch on newly purchased property on Sunset Drive, near the former site of the Winchester Roll Products dam. The Ashuelot Rail Trail travels on the southern river bank from Hinsdale through Ashuelot Village, then crosses the River and continues through downtown Winchester where it turns north toward Westport Village. The Winchester Flood Plain Ordinance prohibits construction in the 100-year floodplain. Mirey Brook enters the River just upstream from the NH 119 bridge. Mirey Brook drains from an extensive wetlands complex in nearby Sunny Valley and is also a fish release site for the Connecticut River Atlantic Salmon Restoration Project. A substantial stratified drift aquifer under Sunny Valley extends into the River Corridor.

The physical geography of the River Corridor changes with the transition from the community to the rural segment: meandering channel in floodplain/wetland forest to a steeper grade with swift current in a boulder strewn channel through upland forest.

The rural segment from the NH 119 bridge to the former site of the McGoldrick dam (which was removed in 2001) has very little development. The village of Ashuelot hosts the historic Ashuelot Covered bridge and several dozen homes on both sides of the River, about half of which are on the river bank or on the opposite side of NH 119 (which runs on the river bank on and off for several miles) from the River. Ashuelot village homes and businesses on the north side of the River are serviced by the Winchester waste water treatment plant.

Unfavorable economic conditions and the floods of October 2005 resulted in the closing of both paper mills on the river's banks in Ashuelot.

Other special features of this segment include class II through IV rapids which attract canoe and kayak enthusiasts from throughout the country, and the state endangered plant species Spiked needlegrass (*Aristida longespica var. geniculata*). The southern border of Pisgah State Park also falls within the Corridor.

Management Goals

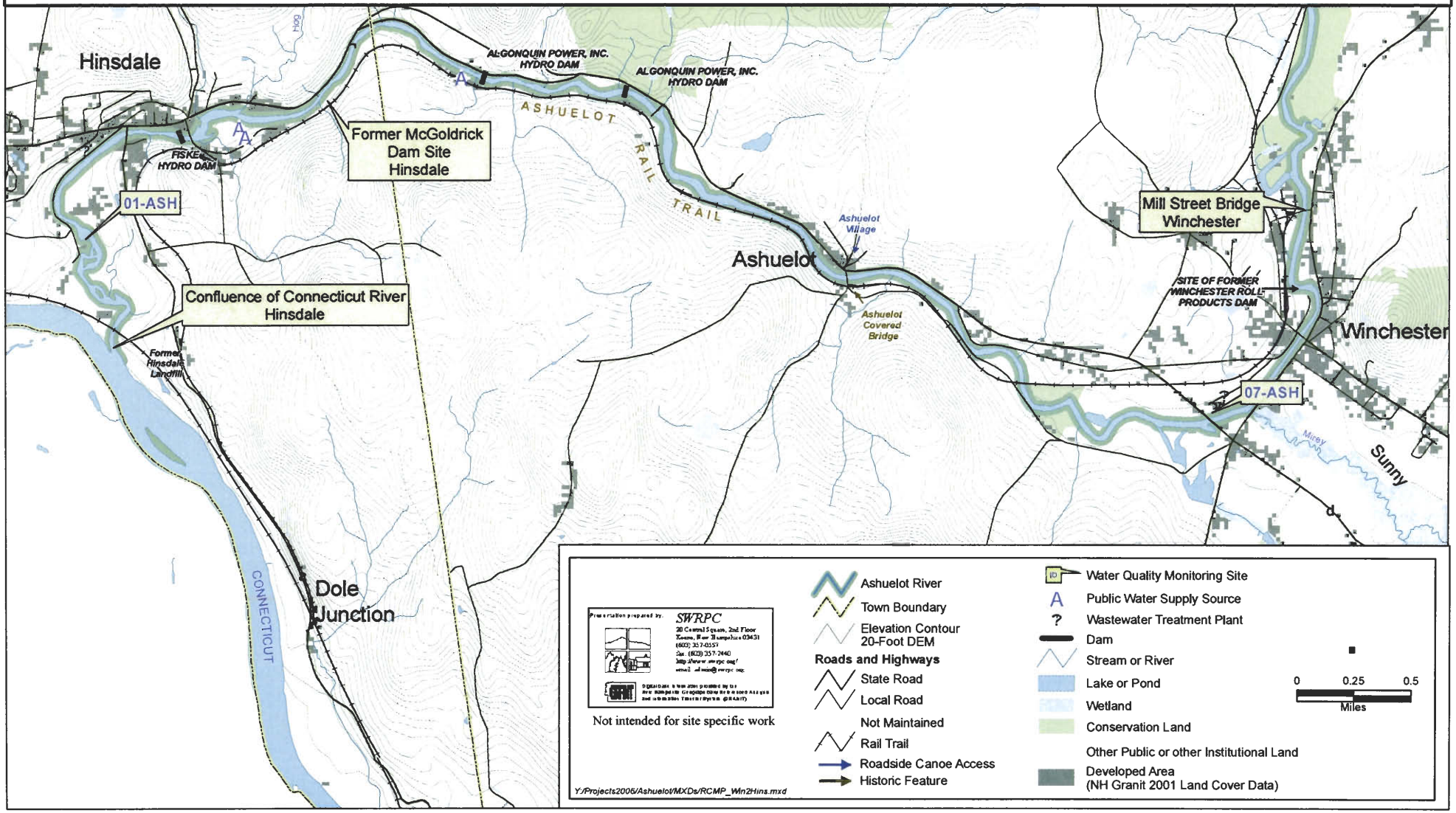
- Prevent sedimentation, nutrient loading, and pollution from storm water runoff in the Winchester village.
- Prevent nutrient and pathogen pollution from the Winchester waste water treatment plant.
- Reduce sediment load.
- Monitor water quality on a regular basis, e.g., quarterly or annually.
- Preserve historic and archeological features.
- Ensure responsible public access to River and natural areas.
- Support NH Fish and Game and US Fish and Wildlife Service Atlantic Salmon Restoration Project regarding eliminating water quality barriers and physical barriers to migratory fish passage and reproduction in the Ashuelot River and its tributaries.

Site/Issue Specific Analysis and Recommendations

- Ensure appropriate storm water management and minimal impervious surfaces associated with expected commercial and industrial development on riparian lands. Continue support of private and municipal land conservation
- Encourage community support for public education regarding stewardship of private and public riparian lands and the River proper
- Monitoring and management of public use of Ashuelot Rail Trail to prevent destruction of resources by overuse or misuse by the public
- Inclusion of Winchester and Hinsdale School Districts in corridor planning and stewardship activities
- Encourage community support for development and maintenance of the Ashuelot Rail Trail
- Discourage development on floodplain lands
- Protect intact riparian "Natural areas", e.g. wetland and floodplain forest system
- Support removal of physical barriers and water quality barriers to migratory fish passage and reproduction in the Ashuelot River and its tributaries

Ashuelot River Corridor Management Plan, 2006 Update

Mill Street Bridge, Winchester to the Former McGoldrick Dam Site, Hinsdale and the Former McGoldrick Dam Site, Hinsdale to the Connecticut River, Hinsdale



Summary of Issues

This chapter addresses two classification segments in Hinsdale: a **1-mile Community** segment from the former site of the McGoldrick Dam (which was removed in 2001) through downtown Hinsdale to the NH 63 bridge followed by a **1.5-mile Rural** segment west from the village to the confluence of the Ashuelot River with the Connecticut River.

The physical geography of the River Corridor changes again here, leaving the narrow steep river channel of the previous segment and opening into a wider low-gradient river flowing over cobbles and sand. The River bank throughout these last two-and-a-half-miles has a variety of land cover types: upland forest; floodplain forest; impervious surfaces of buildings, pavement, and retaining walls; or rural residential development with lawns, roadsides, and pasture.

The corridor in the vicinity of the confluence hosts a variety of riparian, floodplain, and wetland habitats for plants and animals. There is also a suite of conditions in the area which leads to open water year round on the Connecticut here which attracts a concentration of waterfowl and raptors including bald eagles. Peregrine falcons have also been seen in the confluence area. Connection of the homes upstream in Ashuelot to the Winchester waste water treatment plant and the installation of the Hinsdale waste water plant are part of the recent restoration of water quality in this part of the River to Class B. Water quality improvements to the Connecticut and Ashuelot Rivers make possible sport fishing at the confluence where fish species include walleye, northern pike, small mouth bass, and large mouth bass.

The Fort Hill Line Rail Trail crosses the Ashuelot within yards of the Connecticut River. The Ashuelot Rail Trail comes from the south to run on the south bank of the Ashuelot River from just east of Hinsdale village upstream to Winchester. Both of these former rail road corridors are now owned by the State of New Hampshire for use as multiple-use trails or other future transportation system needs.

Another aspect of the confluence of these two rivers is the coincidence of both being enrolled in the NH River Management and Protection Program. The Ashuelot LAC's planning process overlaps with the planning of the Wantastiquet Local River Subcommittee of the Connecticut River (one of five subcommittees on the Connecticut River). The Wantastiquet group also identifies the confluence area as valuable aquatic, riparian, and inland habitat and notes the significant historic and archeological resources of the Hinsdale area. The Vernon hydroelectric dam just a mile upstream on the Connecticut River is also a significant feature in the Connecticut River Corridor.

One of three U.S. Geological Service gauging stations on the Ashuelot is near the confluence with the Connecticut River. The other two are at Surry Mountain dam and the Homestead Woolen Mill dam in West Swanzey. Daily, monthly and annual discharge data have been maintained for the Hinsdale station since 1907. The average annual (water year) discharge of the Ashuelot through 2005 (latest published records) is 684 cubic feet per second (cfs), or about 5,100 gallons per second. This discharge rate roughly translates to about 160,000,000,000 gallons which falls onto the Ashuelot watershed each year. The lowest annual rate of discharge (between 1907 and 2004) was 217 cfs in the 1965 calendar year; the highest was 1,093 cfs in the 1960 calendar year. The highest monthly discharge was 4,392 cfs is March 1936, and the lowest monthly discharge was 49.2 cfs in October 1964. The highest instantaneous peak flow on record was 16,600 cfs on March 19, 1936 while the lowest instantaneous low flow on record was 12 cfs on September 15, 1929. 50% of the past 95 years have had an average discharge rate of 688 cfs or more. At the time of this writing, discharge data for the October 2005 flood was not ready for publication by USGS. The provisional data indicated that the peak flow for October 9th was 11,700 cfs.

Former McGoldrick Dam Site, Hinsdale - Connecticut River, Hinsdale

The McGoldrick Dam once diverted river water to a canal for hydroelectric power generation and the Fiske Hydro Inc. dam in the village, to which a fish ladder will be installed in the near future, is an active hydroelectric generation facility. It is a run-of-the-river impoundment. The River is known to have been dry in the village area for short periods during late summer. There is no consensus about the cause of this de-watering, and it has not re-occurred in recent years.

Other special features of this segment include:

- the Hinsdale Post Office is the oldest continually operating post office in the U.S.;
- state endangered plant species: Three-leaved black snakeroot (*Sanicula trifolia*), Burgrass (*Cenchrus longispinus*), Marsh horsetail (*Equisetum palustre*), Flatstem pondweed (*Potamogeton zoteriformis*), and Knotty pondweed (*Potamogeton nodus*).
- Fort Hill, a Squakeag Indian fort archeological site ca 1640 located north of the mouth of the Ashuelot.

Management Goals

- Prevent sedimentation, nutrient loading, and pollution from storm water runoff in the Hinsdale village
- Prevent nutrient and pathogen pollution from the Hinsdale waste water treatment plant.
- Ensure maintenance of safe minimum instream flow conditions.
- Monitor water quality above and below the village area.
- Conserve historic and archeological features.
- Conserve diverse contiguous riparian and corridor plant communities.
- Ensure responsible public access to River and natural areas.
- Support State and Federal programs to eliminate water quality and physical barriers to migratory fishes.

Site/Issue Specific Analysis and Recommendations

- Ensure appropriate storm water management and minimal impervious surfaces associated with expected commercial and industrial development on riparian lands
- Continued support of private and municipal land conservation
- Encourage community support for public education regarding stewardship of private and public riparian lands and the River proper
- Monitoring and management of public use of Ashuelot and Fort Hill Line trails to prevent destruction of resources by overuse or misuse by the public
- Inclusion of Hinsdale public schools in corridor planning and stewardship activities
- Encourage community support for development and maintenance of the Ashuelot and Fort Hill Line Rail Trails
- Discourage development on floodplain lands
- Protect intact riparian "natural areas," e.g. wetland and floodplain forest systems
- Facilitate fulfillment of migratory fish restoration goals, e.g. removal of physical barriers to fish migration and restoration of seasonal hydrologic cycles.

Appendices

- Management Tools
- Local Land Use Planning
- Annotated Directory of Assistance
- Regulations for Designated Rivers
- Land Use & Soil Conditions
- Water Quality Monitoring Report
- TNC Land Conservation Plan

Atlas of the Ashuelot River

and the Ashuelot River Watershed

Published by

The Ashuelot River Local Advisory Committee

with support from the
Connecticut River Joint Commissions Partnership Program

2 0 2 4 Miles

Scale = 1:150,000 1 inch = 2.4 miles

The Ashuelot River flows 64 miles from its origin at Butterfield Pond in Pillsbury State Park in Washington, NH through nine other southwest New Hampshire towns to join the Connecticut River in Hinsdale, NH.

Ashuelot River Watershed

The Ashuelot's watershed collects water from 425 square miles across 25 towns in southwestern New Hampshire and two Massachusetts towns. The watershed begins with Cherry Brook on the south slope of Mount Sunapee. The eastern border ranges south through the Monadnock Highlands, including the western slope of Mount Monadnock and reaches Mount Grace in Massachusetts.

Hiking & Biking Trails

The Ashuelot Rail Trail follows the River from Hinsdale to Keene. The Cheshire Rail Trail crosses the watershed parallel to NH Route 12. The Monadnock-Sunapee Greenway and Metacomet Trails follow the eastern watershed boundary. There's Hiking and Biking throughout State Parks, State Forests and other Public Lands.

Flatwater Boating

Easy boating from the Cheshire Turnpike Bridge, Keene to Ashuelot Village with short portages at the Colony, Homestead and Winchester Dams and a section of Class 2 water at Westport Village.

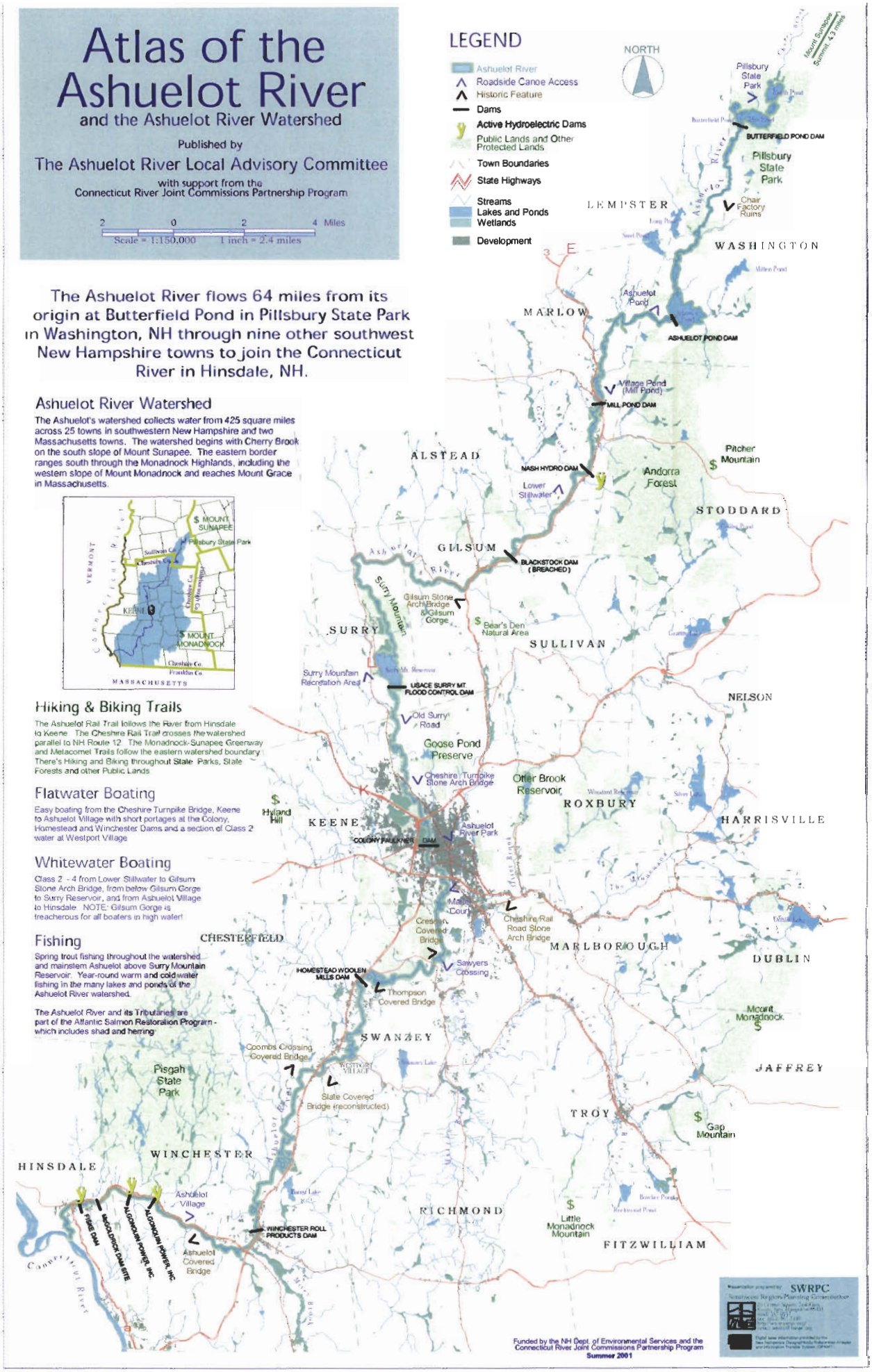
Whitewater Boating

Class 2 - 4 from Lower Stillwater to Gilsum Stone Arch Bridge, from below Gilsum Gorge to Surry Reservoir, and from Ashuelot Village to Hinsdale. NOTE: Gilsum Gorge is treacherous for all boaters in high water!

Fishing

Spring trout fishing throughout the watershed and mainstem Ashuelot above Surry Mountain Reservoir. Year-round warm and cold water fishing in the many lakes and ponds of the Ashuelot River watershed.

The Ashuelot River and its Tributaries are part of the Atlantic Salmon Restoration Program - which includes shad and herring.



Funded by the NH Dept. of Environmental Services and the Connecticut River Joint Commissions Partnership Program
Summer 2001

Presentation prepared by SWRPC
Southwest Region Planning Commission

PUBLISHED BY THE ASHUELOT RIVER LOCAL ADVISORY COMMITTEE

ATLAS OF THE ASHUELOT RIVER

WITH FUNDING FROM THE CONNECTICUT RIVER JOINT COMMISSIONS PARTNERSHIP PROGRAM
AND THE SOUTHWEST REGION PLANNING COMMISSION

THERE IS ONLY ONE ASHUELOT RIVER. Ten towns in southwestern New Hampshire share it. The power of the Ashuelot's moving water is the reason five town centers are where they are. It provided shad and salmon to hunter-gatherer societies prior to European colonization; offers nationally renowned white water boating; supports essential waste water treatment; it is a 64-mile ribbon of water flowing downhill through boulders and swamps, between fern-covered banks, under hemlock thickets, and through pastures and backyards like countless other rivers around the world - but like no other river in the world.

HISTORY

To travel the River is to travel through time. The Ashuelot River provided power for wood and textile manufacturing for 200 years. Before that the River corridor was home to Native Americans for millennia. Villages, factories, farmsteads, dams, stone walls, bridges, and archeological sites (dating back 9,000 years) are each a link in the Ashuelot Corridor's long history with people: Native American, European, and modern American. The natural forces of geology and ecology are little changed, but, the qualities of the landscape are irrevocably shaped by human activity, and in such lays before us a living story. Settlers colonized rounded hilltops in 18th-Century farm communities. Those farm centers stopped growing, or were abandoned, and new villages sprung up on rivers and brooks where homes and businesses co-located with new hydro-powered industry. Clearing forests for timber and agriculture, damming the flowing River for power, and industrial-era pollution profoundly affected the River. Local libraries house "town histories" for most southwestern New Hampshire towns – fascinating chronicles of the comings-and-goings of the individuals, families, and communities that continue today.

PLANT & ANIMAL HABITAT

The Ashuelot River and its riparian land are very special habitats. One of the high values of any river corridor is the unique community of plants and animals that thrives there. Several major habitat types are easily recognized by the casual passer-by: **the Stream Channel itself, River Bank, Floodplain Forest, Wetlands, Upland Forest, and Farmland.** The stream hosts several habitat types as well: steep rocky channels, wide flat gravel-bottomed reaches, and deep slow moving "flat water" areas. These habitat types combine in a seamless mosaic that supports an essential diversity of plants and animals from moose to hummingbirds to trout to lady slippers. Some plants and animals live only in the stream or on its banks. Many others rely on the stream and its banks as part of a larger habitat – in some cases using the river for part of their life cycle, or as one more place to find food or shelter.

Warning! Invasive plant and animal species, species not native to our area, pose a serious threat to the River's ecology. Purple Loosestrife is the most conspicuous invasive plant, and there are many others.

WATER RESOURCES

The Ashuelot River is the central feature of a watershed that covers more than 425 square miles in southwestern New Hampshire. Water moves endlessly through the air we breathe, over the land we live on and through the rock and soil beneath us. The natural environment of which each person, home and business is part, depends on clean water. Growing demand for clean water by the very development that disrupts the natural movement of water raises concerns about ensuring enough clean water for all uses.

Photo courtesy of US Army Corps of Engineers

Ground Water: Stratified drift aquifers (sand and gravel buried by glaciers) are filled with water. This is a particularly rich resource in the towns of Keene, Swanzey, and Winchester. Almost ALL watershed residents rely on groundwater – it doesn't come from somewhere else – it's the same water that falls on our forests, roads and lawns. **Surface Water**: About 160 billion gallons of water drain from the watershed each year by way of the Ashuelot to ultimately join the Connecticut River in Hinsdale.

WARNING ! NON-POINT SOURCE (NPS) POLLUTION - SOIL EROSION, RUN-OFF FROM PAVEMENT, FERTILIZER, GASOLINE & OIL, HEAVY METALS, PESTICIDES , SEWAGE - is a serious threat in the Ashuelot River watershed and may also be one of the most preventable threats to the Ashuelot River. Modest changes in our daily routines at home and work can prevent most NPS pollution.

RECREATION

Residents and visitors alike treasure the Ashuelot River and forested riverbanks for year-round outdoor recreation. Every popular outdoor sport has a place in the Corridor: hiking, biking, fishing, hunting, snow-mobiling, canoeing and kayaking, or just sight-seeing from the car. There are opportunities for all challenge levels from a family roadside picnic to all-day mountain biking or world class white-water boating.

Remember: Most public access to the River enjoyed today is allowed by the graciousness of private land owners. Continued access depends on responsible and respectful behavior by those playing in and around the River – it's as easy as **Carry In / Carry Out.**

The Ashuelot LAC Invites You to be a Steward of the Ashuelot River.

AWARENESS APPRECIATION RESPONSIBILITY

ASHUELOT RIVER LOCAL ADVISORY COMMITTEE c/o SOUTHWEST REGION PLANNING COMMISSION 357-0557
NH DEPT. OF ENVIRONMENTAL SERVICES RIVERS COORDINATOR 271-3503
YOUR LOCAL CONSERVATION COMMISSION

WASHINGTON LEMPSTER MARLOW GILSUM SULLIVAN SURRY KEENE SWANZEY WINCHESTER HINSDALE

Appendix 1. Management Tools

The Ashuelot LAC recommends the following non-regulatory approaches to manage public and private activity for the purpose of preventing or minimizing environmental damage from routine activities in our towns, industry, country neighborhoods, and forests.

Public Education

There is a proven relationship between people's understanding of the workings and values of the natural environment with their willingness to live their daily lives in ways that protect the health of our environment. Effective public education can take many different forms and consist of many different messages. Interested groups or individuals are encouraged to move ahead with their ideas and not hesitate to begin with modest efforts.

- Provide information to stimulate critical thinking about connections between routine activity and consequences which may not be apparent to most citizens, business owners, or public officials.

- Very basic information such as a diagram of the water cycle or a description of the poisons kept under most kitchen sinks can stimulate critical thinking about how each of us affects environmental health.

- Public education is about enabling people to make changes. Make the alternatives to damaging or dangerous activities and materials plain to the audience.

- Likewise, positive messages should be part of a public education campaign. Bring local history and natural features to residents' attention, or describe the activities of area conservation organizations and how residents can be involved.

- Avoid overloading the audience with details. Present the fundamentals with enough detail to clarify and make it real. And, always provide the audience with contacts or other ways to get more information to get involved.

Information enlightens and empowers. Most of us want to do what is right for our own welfare and to be good neighbors. Public education for conservation and environmental protection can give people the information they need to do that. There is no end to the need for public education.

Appendix 1. Management Tools

How to get information to people . . .

Many towns have local newsletters, printed monthly or quarterly. These will usually print public education materials.

Single page fliers can be very effective. Local business leaders or civic groups are often willing to defray the cost of printing and postage when the fliers acknowledge their generosity. Printed fliers can also be made available at public places (libraries, post offices, schools, town meeting, etc.) and private gathering places with permission (e.g. stores, taverns, fraternal organizations, etc.)

Workshops, seminars, or guided walks featuring speakers or instructors from any of the many conservation agencies and organizations (Appendix 4.) are often very popular and can be held in conjunction with other community activities such as meetings of local groups or town government. Presentations can also be made by local experts or enthusiasts.

Public involvement activities, e.g. canoe trips, bird watching, wildflower walks, trail maintenance, and roadside clean-up are excellent ways to build appreciation for local environmental conditions and the values of natural resources.

Assistance for designing and conducting public education ...

Discussing your public education ideas with local teachers, school principals, or school district staff can provide access to the very important audience: students. Ask local teachers about their curriculum and discuss the inclusion of conservation ideas and awareness of local resources in their classroom activities. These meetings can create a tremendous flow of information and ideas both ways. Many public schools have innovative and effective approaches in place.

Keene State College has primary and secondary education, geography, and environmental studies programs which can provide student interns for a variety of research and outreach activities. Likewise, Antioch New England Graduate School has programs in environmental studies, resource management, environmental education and communications. Internships are a required part of Antioch's degrees and the School has provided many excellent interns to environmental projects throughout the Ashuelot corridor. The Harris Center for Conservation Education and Stonewall Farm both conduct ongoing environmental education programming and can provide professional advice in designing and conducting public education.

Public education for conservation and environmental protection is eligible for funding under some private and public grant programs. Grant funds can enable the development of highly effective publications, seminars, videos, or radio messages and the use of professional communications and conservation services. The Connecticut River Joint Commissions Partnership Program, NH DES Non-Point Source Program, and the McCabe Foundation are potential sources of grant funds.

See the descriptions of organization and agency activities in Appendix 3.

Best Management Practices to prevent damage from Timber Harvest, Soil Erosion, Stormwater Runoff, and Potential Contamination Sources

Environmental agencies and industry associations have developed sets of guidelines to be used during activities that disturb soil and terrain, re-route surface water runoff, or involve the handling of chemicals that will be pollutants if released into the environments. Rather than prohibit activity that has the potential to harm environmental and public health, public policy supports managing those high risk activities to prevent or minimize environmental harm. The guidelines for managing high risk activities are known universally as Best Management Practices or BMPs. **BMPs can be part of advisory public education, or, BMPs can also be required as part of other permitting or regulatory processes.**

Timber Harvest

There are several authoritative sources for timber harvest BMPs. The NH Dept. of Resources and Economic Development, the NH Timberland Owners Association, the Society of the Protection of NH Forests, and UNH Cooperative Extension Service all provide publications of these BMPs, which are principally aimed at preventing soil erosion and minimizing damage to the remaining timber stand. The Society has also produced a publication and video on the subject of timber harvest aesthetics.

Timber harvest BMPs address construction and reclamation standards for landings and skid trails. Slowing runoff over exposed soil, reducing loss of forest soil to erosion, and preventing sedimentation of surface waters are primary goals during and after harvest.

- Careful planning for the location and grade of landings and skid trails to minimize slopes where soil is exposed;
- Installation of water bars to divert runoff from the trails rather than allowing trails to become stream beds during storms and spring snow melt;
- Using culverts, bridges, or fords made of limbs at stream crossings on skid trails and truck roads are called for during logging.
- Reclamation practices include restoring original slopes and seeding exposed soil with grass mixtures.
- Measures to reduce damage to residual timber stand include careful felling and skidding as well as intelligent planning of skid trails.

These kinds of measures require some planning and additional costs but in the long run protect the health of the timber stand and the forest ecology. The goal is to attain harvest goals with the least possible impact on the rest of the forest.

Appendix 1. Management Tools

Soil Erosion on Construction Sites

Soil erosion during construction with excavation and road building can damage nearby streams and ponds by clouding the water, covering the bottom, and adding excessive nutrients to the aquatic system. Erosion also means the loss of valuable soil from the site.

During construction while the soil is protected by plants or other cover, erosion can best be checked by trapping runoff in basins dispersing it across open flat areas to reduce to the speed of the water which will allow the soil to settle to the ground. Silt fences made of hay bales or synthetic mesh both slow soil-laden water to allow settling and filter soil out of running water. Another approach is to avoid grading or piling dirt to create steep slopes which can become rushing streams during rainstorms carrying away tons of soil.

Requirements for erosion and sedimentation control measures are common elements of site plan review regulations and the State's Site Specific or Alteration of Terrain permit. The USDA Natural Resources Conservation Service is an excellent sources of assistance regarding erosion and sedimentation BMPs.

Storm water Runoff

Storm water runoff from pavement and rooftops poses two threats to a river system: 1) increased amount of water draining to streams which will increase the magnitude of flooding downstream and decrease the amount of water soaking in to the soil and recharging ground water and 2) transport of chemical pollutants in solution or as sediment directly from pavement to streams. BMPs for storm water management are designed to slow runoff, allow water to infiltrate into the soil on-site, and allow sediment to settle out before runoff leaves the site. A common and effective system directs runoff into grassy swales and retention basins. Systems can also provide a means of removing contaminants on-site, e.g. uptake by aquatic plants in a treatment lagoon. Storm water management is a common element of site plan review. The USDA Natural Resources Conservation Service is an excellent source of assistance regarding erosion and sedimentation BMPs.

Potential Contamination Sources

Potential contamination sources (PCSs) are places where the storage, handling, use, or transportation of regulated substances in regulated quantities take place. The US Environmental Protection Agency has listed dozens of chemicals that are toxic to plant and animal life if released into the environment. These chemicals are regulated by federal and state agencies when

ever they are found in "regulated quantities". For example, the transportation and storage of fuel oil is regulated only in quantities of 1,100 gallons or more. Some regulated substances are regulated when 10 or 15 pounds are used. To help build a local awareness of the hazards of PCSs, best management practices for PCSs have been developed to provide local officials some yardstick by which to assess the conduct of local businesses or other activities in handle potential contaminants. These BPMs were designed in conjunction with the Ground Water Protection Act

and the Wellhead Protection Program. PCS BMPs can also be advised for non-regulated threats, such as unregulated quantities of toxics or for non-regulated substances such as livestock manure.

PCS BMPs address weather proof storage; keeping spillage or waste from regulated substances contained and preventing release into sewers, soil, or runoff; and having an emergency response plan that dictates a chain of contacts and actions in the event of an accidental release.

Planning Commissions and NH DES are sources of assistance regarding BMPs for potential contamination sources.

Conservation Easements

Concern for the fate of undeveloped land is prevalent among residents and municipal boards in the Ashuelot River Corridor. Preventing or restricting development by regulation is contentious and can be unfair to property owners; land is capital and each land owner is entitled by constitutional law to a reasonable economic return on their investment in land. There is also legal precedent for the existence of a valid public purpose in the protection of wilderness and other undeveloped land. The public benefits include preservation of biological diversity, protection of drinking water supplies, conservation of timber supplies, and the simple fact that green space makes people feel good.

An equitable way to provide the public benefits of open space without imposing economic hardship on landowners is the use of conservation easements to protect land from development. Conservation easements are legal mechanisms by which a buyer pays the landowner value of the land's development potential. That is, the difference between the value of the land at full development potential and the value of the land with limited of no development potential. The landowner can retain ownership of the land but is legally bound by a deed restriction against developing the land. The easement can be purchased by any private or public entity with legal standing to expend funds and own property.

The Monadnock Conservancy, the Society for the Protection of NH Forests, the Nature Conservancy, the Audubon Society of NH, and the NH Dept. of Resources and Economic Development all facilitate, purchase, and/or monitor conservation easements in the Ashuelot River Corridor. Municipalities and property owner associations can also purchase easements. The Harris Center for Conservation Education, the Monadnock Sunapee Greenway Committee, and Monadnock Perspectives participate in coordinated planning for land conservation. See Appendix 4. for assistance contacts.

Easements can also be donated by landowners. Donation can provide landowners with various tax advantages. And, of course, outright purchase of land for conservation is another alternative.

There are also innovative zoning systems that allow trading of development credits between zoning districts to allow higher density development in one zoning district in return for limiting development in another. The burden of financing that trade-off falls on developers. This is an alternative to easements or purchase, which does not require the municipality or conservation group to raise funds.

Appendix 2. Local Land Use Planning

Roles of Local Boards & Offices

Note: The synopsis of each board or office is followed by reference to New Hampshire legislation by which each is established and empowered as Revised Statutes Annotated (RSA) Chapter Number.

Town Meeting / Local Legislative Body / Voters

The voters residing within the political boundaries of a NH Town are collectively known as the Local Legislative Body. For all practical purposes, the Local Legislative Body acts at Town Meeting - either annual meetings or special meeting convened for emergency matters. All local ordinances and codes must be ratified by the Local Legislative Body. Voting takes place by ballot prior to Town Meeting and on the floor of the Town Meeting. NH RSA 39.

Board of Selectmen

Selectmen, the executive office of Local Government, are elected by the Local Legislative Body. Selectmen's responsibilities are broad, including financial and personnel management of town government, municipal law and code enforcement, and overseeing Town Meeting. Selectmen are typically designated to enforce the zoning ordinances, health codes, and building codes by provisions of those laws. NH RSA 41.

Note: **Municipalities large enough to be designated as "cities" install an elected mayor and city council to act as executive office and local legislative body, respectively, regarding land use controls.** Cities maintain Planning Boards, Zoning Boards of Adjustments, and Conservation Commissions the same as towns do with Selectmen and Town Meeting. Keene is the only Ashuelot Corridor town with a mayor and city council.

Planning Board

The Planning Board is one of three land use boards which cities and towns may establish by vote of the local legislative body. The historic commission and heritage commission are the other two. The fourth land use board, the zoning board of adjustment is established by law where ever a zoning ordinance in adopted. Planning Board members may be either appointed by local Selectmen or elected by local legislative body. Planning Boards are required to develop and **maintain municipal Master Plans.** Planning boards are also typically responsible for **amendments to the zoning ordinance**. In towns with zoning ordinances, Planning Boards may also adopt regulations for the Board's use in **reviewing site plans** where a change of land use or expansion of existing use is proposed. Where site plan regulations exist all such proposals are subject to the Board's review and approval prior to issuance of building permits. Planning Boards may also develop and adopt subdivision review regulations with or without a zoning ordinance. Variously: RSA 673 and 674.

Appendix 2. Local Land Use Planning

Zoning Board of Adjustment

Zoning Board of Adjustments is established as a provision of any adopted zoning ordinance as board of **appeals for administrative interpretation of the spirit and intent of the zoning ordinance, for variances from explicit provisions of the zoning ordinance, and for special exceptions as provided for by the zoning ordinance.** Appeals and requests for special exceptions arise from applications for building permits or subdivision or site plan approval. Zoning Board members are either elected by local legislative body or appointed as prescribed by the local legislative body. The Zoning Board may grant a variance only if the Board finds that literal enforcement of the zoning ordinance will result in unique hardship to the applicant and that granting the variance is not contrary to public interest. Notice that diminished economic return may not constitute a hardship. Zoning Boards may also be designated to hear appeals regarding applications for building permits. RSA 674 and 676

Conservation Commission

Conservation Commissions are established by local legislative body to advise other town officials and boards regarding **the use and protection of natural resources** within their town. Commission members are appointed by the Selectmen or Mayor. State law prescribes more specific responsibilities to index open space and identify areas of aesthetic or ecological value including wetlands, and make recommendations for the protection or management of those areas to the Board of Selectmen. Conservation Commissions also have the opportunity to comment on applications for NH Wetlands Permits. RSA 36-A

Heritage Commission / Historic District Commission

Historic Commissions are established by local legislative body to advise other town officials and boards in matters of **inventorying and protecting the towns cultural resources**, primarily man-made features and their natural, historic, and aesthetic contexts. Historic Commission members are appointed by Selectmen or Mayor. Historic District Commissions are established by local legislative bodies where a historic district has been established. Historic District Commissions have responsibility to make recommendations for the adoption or amendment of a historic district ordinance and regulations. Variously, RSA 673, 674 and 676.

Code Enforcement / Health Officer / Building Inspector

The Board of Selectmen is authorized to enforce building codes and zoning ordinances as well as a health officer to enforce public health laws and rules. The local legislative body may elect to establish a building inspector or other code enforcement officer to perform those duties under supervision of the Selectmen.

Appendix 2. Local Land Use Planning

Relationship Between the Master Plan, Zoning Ordinance, and Site Plan & Subdivision Review

The municipal **Master Plan is a statement of policies for the use of land and other resources within a town.** Master Plans typically set forth goals and objectives for the future use of land and other resources with recommendations for a variety of regulatory and non-regulatory measures. The policies and recommendations of the Master Plan should be based on the findings of research into the historic, recent, and expected future conditions of various natural and social resources. Master Plans are the responsibility of Planning Boards, however, any residents can initiate and participate in the creating or revising a local Master Plan. Typically, Master Plans are updated by the Planning Board with cooperation of other local boards and the general public and often consultant services are used for research, mapping, and/or analysis. The local Master Plan is an official but advisory document which requires adoption by the Planning Board following a public hearing process.

Zoning is local law which establishes 1) standards for lot dimensions and 2) permitted uses for land within a town. Ideally, the Zoning Ordinance implements the future land use recommendations of the Master Plan. The Master Plan is the public policy which justifies the establishment of the lot standards and permitted uses required by the Zoning Ordinance. Zoning may also regulate the placement and characteristics of signs, the allowable extent of impermeable surfaces, and the emission of noise, light, or smoke from properties. The geographic boundaries of zoning districts, that is the lands where those district standards apply, may be either 1) fixed and defined by natural features, streets and roads, or property boundaries, or, 2) defined by the occurrence of certain conditions, such as wetlands or steep slopes. In the latter, the standards of "overlay districts" are invoked only where specified conditions are discovered. Zoning standards can be proposed by the Planning Board or by any other resident through petition to Town Meeting (submitted to Selectmen) with required public hearings (see RSA 39:3). Zoning Ordinances are adopted by vote of the local legislative body.

Subdivision and Site Plan Review Regulations are used by the Planning Board to review the specifications of proposed new lots created by subdivision and/or proposed new uses on a property or the expansion of an existing use. The review is to ensure compliance with local

and state requirements. Site Plan Review regulations are criteria by which the Planning Board determines if 1) the application contains sufficient information for the Board to review the application based on the provisions of the regulations and 2) the proposed change or expansion of use conforms to the spirit and intent of the zoning ordinance and the master plan. Site plan and subdivision review typically assess lot dimensions, environmental and historic resource conditions, erosion control and drainage plans, and the layout of roads and utilities.

Conservation Oriented Zoning Standards

Conventional zoning creates use districts with fixed boundaries where the properties within the boundaries are subject to the dimensional and use standards prescribed by the ordinance. District boundaries are often defined property lines, road, and town boundaries. Fixed boundary districts cannot address resource protection needs adequately. Historic or natural resources are often scattered across the landscape without regard to the geometry of political boundaries, property lines, or roads. **Overlay zoning was developed to protect dispersed but important resources. Wetlands, steep slopes, shoreland, and other areas with special geologic, hydrological, or ecological characteristics are best protected using overlay zoning.** The use standards for overlay districts are developed, approved, and administered in the same protocol used for conventional zoning. The difference is that the standards are only invoked and supersede the standards of fixed boundary districts where the special conditions occur.

Floodplain zoning deserves a special note. Many towns have floodplain zoning districts wherein local use standards conform to the Federal Emergency Management Administration's requirements for the federal flood insurance program. Property owners are not eligible for flood insurance benefits unless the town in which they are located enforces FEMA floodplain use standards. These standards were not designed as environmental protection measures. They are primarily intended to limit property damage and personal injury in the event of a flood. The standards address design and construction of building, fuel tanks, and septic systems in floodways - areas designated as susceptible to 100-year floods. Environmental benefits of this program are ancillary but real. For example, FEMA standards prevent the release of fuels, sewage, and debris during a flood. Towns can develop local floodplain protection standards in addition to the FEMA standards for the purpose of protecting natural resources of floodplains.

Cluster development is an innovative zoning technique which allows for smaller individual lot sizes created by subdivision with the stipulation that the overall development density for the entire development project conforms to the prevailing zoning district standards. This is accomplished by requiring the developer to set aside some percentage of the original property as open space. For example, if a district has a two-acre minimum lot size a developer could subdivide a twenty-acre forest property into ten building lots. That project would conform to the district density standard of one house for every two acres. It would also turn the entire twenty acres into front and back yards. If the town has **a general provision of the zoning ordinance** to allow cluster development, the developer could create ten half-acre lots, use some additional acreage for a private road, and leave the remaining ten or twelve acres as undeveloped forest and deeded as conservation land. The district density standard of one house for every two acres is maintained; the neighborhood, town, watershed retain some conservation land; and the developer has ten marketable properties.

Transfer of development rights is another innovative technique by which as **a general provision of the zoning ordinance** property owners or developers may increase the density or intensity of a land use on one property by decreasing the allowable density on another. This is accomplished by one property owner literally paying another property owner to transfer some quantity of density from the second property to the first. For example, a developer with designs for housing construction in a one-acre-minimum-lot-size district could pay another property owner in that district the difference in the value of the latter's undeveloped property under one-

acre lot size zoning standards and, say, two-acre lot size standards. That transaction would restrict the latter's property to a lower density and allow the developer to increase the density in his housing development. This has applications in conservation if the town has areas or properties targeted for greenbelt development, for example. Town officials could facilitate the purchase of development rights from properties targeted for land conservation.

Historic districts are authorized by state statute and become jurisdictions with land use standards distinct from the town's prevailing zoning ordinance. While created under the same protocol as a conventional zoning district, historic districts can be subject to strict specifications for building design, exterior renovation, landscaping, and even paint colors in order to preserve the historic integrity of the district. Historic districts are typically village centers or industrial building complexes.

Appendix 3. Directory of Assistance

Town Government

Each town is governed by officials as designated by the local legislative body (a.k.a. Town Meeting, or City Council). Local officials and boards whose roles include issues related to stewardship of the Ashuelot River Corridor include the Board of Selectmen, Planning Board, Conservation Commission, and Health Officer. Contacting the Town Clerk or Selectmen's Secretary is often the most efficient way to reach other local officials due to annual changes in town office business hours, meeting times for local boards, and the names of local officials.

There are several organizations that maintain directories of local officials, including Southwest Region Planning Commission (357-0557), NH Department of Transportation (271-3734), and the NH Municipal Association (1-800-852-3358).

Gilsum	Town Office 357-0320
Hinsdale	Town Office 336-5710
Keene	City Hall 357-0133
Lempster	Town Office 863-3213
Marlow	Town Office 446-2245
Sullivan	Town Office 847-3316
Surry	Town Office 352-3075
Swanzey	Town Office 352-7411
Washington	Town Office 495-3661
Winchester	Town Office 239-4951

Appendix 3. Directory of Assistance

Ashuelot River Regional Organizations & Agencies

Ashuelot River Local Advisory Committee

c/o Southwest Region Planning Commission
20 Central Sq., 2nd Floor, Keene, NH 03431
tele: 357-0557, FAX: 357-7440, e-Mail: jporter@swrpc.org
Jeff Porter, Assistant Director

Established under NH RSA 483-B, the LAC is authorized to develop and promote the Ashuelot River Corridor Management Plan and afforded the opportunity to review and comment on applications for environmental permits within the Ashuelot River Corridor. Principle interests are public education for stewardship of River Corridor resources and assistance to local land use boards regarding the same. The LAC is made up of representatives from the ten Corridor towns.

Antioch New England Graduate School

Environmental Studies Department
40 Avon St., Keene, NH 03431
tele: 357-3122
Kay Delanoy, Practicum Coordinator

Antioch offers graduate programs in environmental studies and resource management. Antioch students have worked with government and private entities in a great variety of research, public education, and policy-making projects. Antioch faculty and interns are valuable resources for local conservation projects. (The Rachael Marshall Outdoor Learning Labs (director: Paul Bocko ext. 250, paul@anei.org) provide a learning atmosphere for students within the Ashuelot River Corridor)

Ashuelot Valley Environmental Observatory (AVEO)

Science Center 183, Mailstop 2001, Keene State College
Keene, NH 03431
tele: 603-358-2069
Contact: David Moon
moon@aveo.org

AVEO connects local residents to scientists to monitor and interpret the Ashuelot Valley ecosystem The organization strives to engage the population to increase the body of scientific environmental information and use that to make better decisions regarding City Planning. AVEO is active in a variety of projects including bird studies, river water quality, dam removal, forest inventory, and climate change.

Connecticut River Joint Commissions

P.O. Box 182
154 Main Street
Charlestown, NH 03603
tele: 826-4880
Sharon Francis, Executive Director

The CRJC is established by the legislatures of NH and VT for the purpose of safeguarding the unique natural and cultural heritage of the Connecticut River Valley. The CRJC offers a grassroots support small grant program: the Connecticut River Partnership Program. Competitive Partnership grants fund local conservation and education activity in the Connecticut River

watershed. The CRJC is active with the legislatures and environmental agencies of both states as well as at the federal level.

Connecticut River Watershed Council
15 Bank Row
Greenfield, MA 01301
tele: 413-772-2020
email: cgwyther@ctriver.com
Chelsea Reiff Gwyther, Executive Director

Public education and interagency networking regarding stewardship and environmental policy.

Friends of Open Space in Keene
P.O. Box 255
Keene, NH 03431
tele: 352-5500
email: phansel@filtrine.com
Peter Hansel, President

Harris Center for Conservation Education
83 King's Highway
Hancock, NH 03449
tele: 525-3394
Meade Cadot, Director

The Harris Center conducts a public education program with activities both at the Harris Center and in area schools. The Harris Center is also active in land conservation in the Monadnock highlands. Harris Center staff are an excellent resource in these subject areas.

Keene State College Science Division
229 Main St.
Keene, NH 03431
tele: 358-2085
Dr. Gordon Leversee, Dean

The Science Division encourages internships and practical term-projects for undergraduate students. Students and faculty in the environmental studies and geography programs are especially interested in working with community-oriented conservation issues in the Ashuelot River watershed. Faculty conduct research in water quality and ecology of the Ashuelot River.

Monadnock Conservancy
P.O. Box 337
Keene, NH 03431
tele: 357-0600
email: staff@monadnockconservancy.org
Jack Calhoun, President

The Conservancy's mission is to promote and facilitate land conservation for the preservation of natural and cultural heritage. The Monadnock Conservancy's range of interest includes Keene, Swanzey, Sullivan and Winchester in the Ashuelot Corridor. The Conservancy maintains a network of local members who represent the Conservancy to their respective towns, and vice-versa.

Appendix 3. Directory of Assistance

NH Fish and Game Department, Region 4

15 Ash Brook Court
Keene, NH 03431
tele: 352-8798

The Region 4 office of the NH Fish and Game Department is staffed by an officer whose principal duties are public safety and law enforcement. The District office can provide contact with other Department personnel, e.g. fisheries and game biologists.

Southwest Region Planning Commission

20 Central Square, 2nd Floor
Keene, NH 03431
tele: 357-0557

Provides local planning assistance; conducts regional planning activities; provides liaison between state and local interests; maintains and manages a repository of socio-economic, environmental, and geographic information; and participates in statewide policy and program activity in all matters regarding community planning. Serves 36 towns in Cheshire and Hillsborough Counties. Is one of nine NH regional planning agencies.

Upper Valley Lake Sunapee Regional Planning Commission

30 Bank Street
Lebanon, NH 03766
tele: 448-1680

Provides local planning assistance; conducts regional planning activities; provides liaison between state and local interests; maintains and manages a repository of socio-economic, environmental, and geographic information; and participates in statewide policy and program activity in all matters regarding community planning. Serves 26 towns in Sullivan and Grafton Counties. Is one of nine NH regional planning agencies.

US Army Corps of Engineers, Surry Mountain

Surry Mountain Flood Control Dam and Otter Brook Food Control Dam
tele: 352-2447
also: Technical Services
New England District
US Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Operates Surry Mountain Dam for flood control and manages federal lands of Surry Mountain Flood Control Reservoir for public recreation and wildlife habitat.

US Fish and Wildlife Service, Conte Refuge

The Great Falls Discovery Center
38 Avenue A
Turners Falls, MA 01376
tele: 413-863-0209
Implements research, habitat management, and public education regarding the purposes of the Silvio Conte Refuge for the Connecticut River Watershed. Refuge activity includes in-stream habitat protection for migratory fish in the Ashuelot River and tributaries.

Appendix 3. Directory of Assistance

County-Level Organizations & Agencies

Cheshire and Sullivan Counties Conservation District
11 Industrial Park Drive
Walpole, NH 03608-9744
tele: 756-2988
USDA Natural Resources Conservation Service
Debby Hindman, District Manager

Cheshire County Cooperative Extension Service
800 Park Ave
Keene, NH 03431
tele: 352-4550
Lauren Bressett, Administrator

Statewide Organizations

Appalachian Mountain Club
P.O. Box 298
Gorham, NH 03581
tele: 466-2721

Activities include public education and political activity regarding environmental policy, land conservation, and environmental education. Maintains Appalachain Trail and trail amenities.

NH Audubon Society
3 Silk Farm Road
Concord, NH 03301
tele: 224-9909

Activities include public education and political activity regarding environmental policy, land conservation, and environmental education. Organizes an annual migratory bird census in the Ashuelot River Watershed conducted by local volunteers.

NH Association of Conservation Commissions
54 Portsmouth Street
Concord, NH 03301
tele: 224-7867
Deb Hinman, President

Provides networking among NH Conservation Commissions through a quarterly newsletter and participates in legislative activity regarding environmental policy.

NH Farm Bureau
295 Sheep Davis Road
Concord, NH 03301

tele: 224-1934
Wayne Mann, President

NH Rivers Council
54 Portsmouth Street
Concord, NH 03301
tele: 228-6472
email: c_paulsen@nhrivers.org
contact: Carl Paulsen

Public education and networking among grassroots organizations, state and federal agencies and legislators regarding river protection policy and programming; supports NH Rivers Management and Protection Program implementation.

NH Timberland Owners Association
54 Portsmouth Street
Concord, NH 0331
tele: 224-9699

Landowner association participating in public education and political activities regarding land management, timber management and marketing, and public policy.

NH Youth Conservation Corps
Student Conservation Association
689 River Road
P.O. Box 550
Charlestown, MA
tele: 543-1700

Organizes and manages student work teams for conservation activities.

NH Wildlife Federation
54 Portsmouth Street
Concord, NH 03301
tele: 224-5953

The Nature Conservancy
New Hampshire Field Office
22 Bridge Street, 4th Floor
Concord, NH 03301
tele: 224-5853
naturalnewhampshire@tnc.org

Sierra Club, NH Chapter
40 North Main Street, 2nd Floor
Concord, NH 03301
tele: 224-8222

Society for the Protection of NH Forests
54 Portsmouth Street
Concord, NH 03301
tele: 224-9945

Activities include public education and political activity regarding environmental policy; promotes land conservation and forest management; owns and manages conservation land.

Trout Unlimited River Restoration
18 Low Street
tele: Concord, NH 03301-4902
226-3240

Activities include public education and political activity regarding stream protection. Also conducts stream habitat improvement and restoration projects and promotes stewardship.

State Government Agencies

NH Department of Environmental Services
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095
tele: 271-3503
NH Rivers Management and Protection Program
Steven Couture, Rivers Coordinator
Volunteer River Assessment Program
Ted Walsh Coordinator

NH Department of Resources and Economic Development
172 Pembroke Road
P.O. Box 1856
Concord, NH 03302
Sean O'Kane, Commissioner
Bureau of Forests and Lands
tele: 271-2214
NH Natural Heritage Bureau
tele: 271-2215 x303

NH Department of Transportation
Bureau of Environment
Room 160
7 Hazen Drive
Concord, NH 03302-0483
tele: 271-3226
William Hauser, Administrator

NH Fish and Game Department
11 Hazen Drive
Concord, NH 03301
tele: 271-3421 (License Information)
Lee Perry, Executive Director
tele: 271-3211, Public Affairs

NH Department of Cultural Resources
20 Park Street
Concord, NH 03301
tele: 271-2540

Appendix 3. Directory of Assistance

Van McLeod, Commissioner

NH Office of Energy and Planning
57 Regional Drive, Suite 3
Concord, NH 03301
tele: 271-2155, fax: 271-2615
Jack Ruderman, Acting Director

NH Division of Historical Resources
19 Pillsbury Street
Concord, NH 03301
tele: 271-3483
Nancy A. Dutton, Director

Federal Government Agencies

US Army Corps of Engineers, New England
Technical Services
New England District
US Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751
tele: 978-318-8221

US Environmental Protection Agency
Team New Hampshire
John F. Kennedy Federal Building
Boston, MA 02203-2211
tele: 617-918-1581
e-mail: deloi.carl@epamail.epa.gov

US Fish and Wildlife Service, New England
Regional Office
300 Westgate Center Drive
Hadley, MA 01035-9589
tele: 413-253-8200
email: northeast@fws.gov

US Geologic Survey, New Hampshire
361 Commerce Way
Pembroke, NH
tele: 226-7800

Conducts research, maintains data and issues reports regarding geology and hydrology including stream flow data, ground water distribution, and water use.

Appendix 4. Regulations Affecting the Ashuelot River as a Designated River

EXISTING FEDERAL AND STATE LAWS AND REGULATIONS AFFECTING DESIGNATED RIVERS
March 2006

TOPIC	FEDERAL	STATE
I. Water quality		
I A. Protection of water Quality	**Clean Water Act: 1972 (3 USC 1251-1376)** Restore and maintain the chemical, biological and physical integrity of U.S. waters. **Wild and Scenic Rivers Act (16 USC Chapter 28)** By executive order, all federal agencies must make all reasonable efforts to avoid negative impacts to all rivers designated as Wild and Scenic and those listed in the Nationwide Rivers Inventory as potential Wild and Scenic Rivers.	**RSA 483:9:** Water quality shall be maintained at class A or B standards. **RSA 483:7-a:** Water quality shall be maintained at Class A or B for rivers designated as "natural" and Class B for rivers designated as "rural", "rural -community" or "community". **RSA 482-A:3:** Permit from DES Wetlands Bureau required for excavation, dredge, fill or construction in or on any banks, flat, marsh or swamp in and adjacent to any waters of the state. **RSA 483-B** Comprehensive Shoreland Protection Act **RSA 485-C** Groundwater Protection Act **Wt 100-800:** NH Wetlands Program rules **Env-Ws 420:** Ground water reclassification **Env-Ws 401:** State surface water discharge permits **Env-Wm 1403**: Groundwater Management and Groundwater Release Detection Permits **Env- Ws 1400**: Shoreline Protection Rules **Env-Ws 1700:** Surface water quality regulations **Env-Ws 451-455** Water Quality Certification Regulations (401 Water Quality Certificate)
I B. Sources of erosion and sedimentation	**Soil Conservation Act (16 USC 590a)** Directs Natural Resource Conservation Service to prevent soil erosion through local regulations and watershed improvement projects. **Clean Water Act (33 USC 1239)** relates to regulation of nonpoint source pollution.	**RSA 485-A:17** Alteration of terrain permit, required for major earth disturbance. **Env-Ws 415:** Permits for RSA 485-A: 17 Activities
I B 1. Lumber harvesting practices		**RSA 227-J:9** No more than 50% of the basal area of trees shall be cut; leaving a well distributed stand of healthy growing trees within 150 feet of any fourth order or higher stream, or within 50 feet of any other stream which normally flows throughout the year, unless prior written consent of the director of the Division of Forest Lands or the director's agent is obtained and all other state and local permits have been secured. **RSA 485-A:17** Best Management Practices required in timber harvesting. **RSA 482-A:3V** Forest Management limited to minimum impact activities. **Res 5401.02(a)** A permit is required to float timber on surface waters of the state. **RSA 483-B** Comprehensive Shoreland Protection Act **Env-Wm 1400** Shoreland Protection Rules
I B 2. Road, bridge and building construction	**Rivers & Harbors Act of 1899: (33 USC 401) Clean Water Act (33 USC 1344)** Need federal permit to construct dams, bridges, piers, etc., in any navigable water. **Wild and Scenic Rivers Act (16USC Chapter 28)** By executive order, all federal agencies must make all reasonable efforts to avoid negative impacts to all rivers designated as Wild and Scenic and those listed in the Nationwide Rivers Inventory as potential Wild and Scenic Rivers.	**RSA 482-A:3** Construction of structures in or adjacent to wetlands or surface water require permit from DES Wetlands Bureau. **Wt 100-800:** NH Wetlands Program rules

Appendix 4. Regulations Affecting the Ashuelot River as a Designated River

TOPIC	FEDERAL	STATE
I B 3. Land tilling near the river		
IB 4. Dredge and fill activities	**Clean Water Act (33 USC 1344)** Establishes permit system for dredge and fill activities in navigable waterways. **Wild and Scenic Rivers Act (16 USC Chapter 28)** By executive order, all federal agencies must make all reasonable efforts to avoid negative impacts to all rivers designated as Wild and Scenic and those listed in the Nationwide Rivers Inventory as potential Wild and Scenic Rivers.	**RSA 485-A:17** A permit is required for any terrain alteration in or on border of surface waters or which will alter natural runoff. **RSA 482-A** Permit from DES Wetlands Bureau required for excavation, dredge, fill or construction in or on any banks, flat, marsh or swamp in and adjacent to any waters of the state. **RSA 483:9** No channel alteration activities shall be allowed in rivers designated as "natural". DES shall encourage the use of native vegetation to stabilize stream banks of designated "rural", "rural community" and "community" rivers. **Wt 100-800:** NH Wetlands Program rules
I B 5. Borrow pits, sand and gravel operations, removal of material from the corridor		**RSA155E:4-a** A permit from the local Zoning Board of Adjustment is required. No excavations within 75 feet of any navigable river or within 25 feet of any other stream, river or brook which normally flows throughout the year. **RSA 485-A:17** Alteration of terrain permit required for major earth disturbance. **Env-Ws 415** Rules governing alteration of terrain (site specific) permits.
I C 1. Septic systems		**RSA 485 A:29** Permit is required prior to system construction. Inspection required before system covered or used. FIX THIS **Env-Ws 1000** Individual sewage disposal system design rules. **Env-Ws 700** Sewerage and waste system treatment system design standards.
I C 2. Setbacks for septic systems		**RSA 485-A:29** Submission and approval of plans and specifications for septic systems. **Env-Ws1008.04** Sewage disposal systems shall be at least 75 feet from surface water. Locate septic system no closer than 125 feet from wetlands or water course.
I C 3. Septage and sludge disposal	**Clean Water Act (33 USC 1345)** Relates to disposal or use of sewage sludge	**Env-Ws 800** Regulations for removal, transportation, and disposal of sludge. **Env-Ws 1600** Septage Management
I D. Pollution from agricultural, residential, municipal and industrial sources	**Soil conservation Act (16 USC 590a)** Directs Natural Resource Conservation Service to prevent soil erosion through local regulations and watershed improvement projects. **Clean Water Act (33 USC 1342)** Requires NPDES permit for point discharge **Clean Water Act (33 USC 1329)** Relates to regulation of nonpoint source pollution.	**RSA 485-A** Water pollution and waste disposal regulations. **RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers **Env-Ws 1400** Shoreland Protection
I D 1. Pesticides		**RSA 430** All pesticide applications must comply with rules adopted by Pesticides Control Board, NH Dept. of Agriculture. **RSA 483** Setback requirements for certain fertilizers. **RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers. (Agricultural use is exempt). **Pes-1001** Restrictions on the use of pesticides to protect ground and surface waters. **Env-Ws 1400** Shoreland Protection

Appendix 4. Regulations Affecting the Ashuelot River as a Designated River

TOPIC	FEDERAL	STATE
I D 2. Manure spreading and fertilizers		**RSA 431:33-35** Manure and chemical fertilizer handling must be done in accordance with Best Management Practices as published by the NH Commissioner of Agriculture, Markets and Food. **RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers. (Agricultural use is exempt). **Env-Ws 1400** Shoreland Protection
ID 3. Storage facilities for petroleum and/or hazardous materials (under and above ground)		**RSA 483-B** Comprehensive Shoreland Protection Act **Env-Wm 507** Storage Requirement **Env-Ws 1400** Shoreland Protection **Env-Wm-1401** Control of underground storage facilities to prevent and minimize contamination of water. **Env-Wm-1402** Control of aboveground petroleum storage facilities.
I D 4. Road Salt		**RSA 485-C:12** Prohibits certain used within any wellhead protection area classified as GAA, including siting or operating a hazardous waste disposal facility or landfill, snow dump, junk or salvage yard or wastewater or septage lagoon, outdoor storage of road salt or other deicing chemicals in bulk.
I D 5. Disposal of plowed snow		**RSA 485-A:13, I(a)** Prohibits discharging of sewage or wastes into surface waters without a permit **RSA 485-C:12** Snow dumps are prohibited in designated wellhead protection areas.
I D 6. Runoff from roads and parking lots	**Clean Water Act (33 USC 1342)** Establishes regulation of Municipal and industrial storm water discharges.	**RSA 485-A:17** Any person whose proposed terrain alteration will impede natural runoff or create unnatural runoff shall submit detailed plans concerning the proposal and any other requested information to the New Hampshire Department of Environmental Services.
I D 7. Landfills; solid waste disposal, recycling depots; oil-collecting tanks		**RSA 483** No new solid waste landfills within the corridor of designated "natural" rivers or segments or within 500 year floodplain of "rural". "rural-community" or "community" rivers. No expansion of existing landfills within 500 year floodplain of designated "natural" rivers. **RSA 483-B** Comprehensive Shoreland Protection Act **Env-Ws 1400** Shoreland Protection **Env-Wm 1901** Solid Waste Management Rules. **Env-Ws 2500** Landfill Requirements
I D 8. Timber operations - slash and mill waste		**RSA 485-A:15** Litter (garbage, crap metal, old cars, trees, etc.) shall not be disposed of in, on the ice over, or on the banks of surface waters. **RSA 227-J:10** No disposal of slash and mill waste in any stream, river, or brook which normally flows throughout the year or within 25 feet of a 4th order stream. **RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers.
I D E. Water quantity, including water withdrawals	**Federal Power Act (16 USC 791)** Every hydroelectric project on a navigable stream requires a Federal Energy Regulatory Commission permit. **Clean Water Act (33 USC 404)** Permits for dams may be conditioned to assure sufficient flows and restrict withdrawals for the protection of fish and wildlife. **Wild and Scenic Rivers Act (16 USC Chapter 28)** By executive order, all federal agencies must make all reasonable efforts to avoid negative impacts to all rivers designated as Wild and Scenic and those listed in the Nationwide Rivers inventory as potential Wild and Scenic Rivers.	**RSA 483-9** No interbasin transfers area allowed. A protected instream flow level shall be established for each designated river. No new dams are allowed on rivers designated as "natural", "rural" or "rural-community" rivers. **Env-Wr 700** Water uses over 20,000 gpd must be registered and report usage.

Appendix 4. Regulations Affecting the Ashuelot River as a Designated River

TOPIC	FEDERAL	STATE
II. Scenic Appearance		
II A. Open space management		**RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers. **Env-Ws 1400** Shoreland Protection
II B. Riparian buffer zones		**RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers. **Env-Ws 1400** Shoreland Protection
II B 1. Setbacks for buildings and roads		**RSA 482-A:26** No structure extending beyond the shoreline of public water may be used as a dwelling. **RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers. **Env-Ws 1400** Shoreland Protection
II B 2. Permitted uses		**RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers. **Env-Ws 1400** Shoreland Protection
II B 3. Lot sizes and river frontage		**RSA 485-A:39** Waterfront property sale and site assessment study.
II B 4. Building heights		**RSA 674:16** Zoning
II B 5. Mobile home regulations		**RSA 674:32** Manufactured housing can be regulated but not excluded from a municipality.
II B 6. Junk yard restrictions		**RSA 236:111-129** Motor vehicle recycling yards and Junk-yard regulations. **RSA 236:90-110** Requirements for control of junkyards and automotive recycling yards.
II C. Location of roads and parking lots		**RSA 230; RSA 231** Layout, construction and maintenance of state highways and city, town and village and district highways. **RSA 47:17** Sidewalks, parking and use of public ways.
II D. Building material choices		**RSA 47:22** Regulation of the use of certain building materials by town governments
II E. Timber operations-cutting for views		**RSA 483-B** Comprehensive Shoreland Protection Act: Minimum setbacks for certain rivers **Env-Ws 1400** Shoreland Protection
II F. Signs		**RSA 236: 69-89** Regulation of outdoor advertising and signs.
III. Recreation		
III. A Water Sports		**RSA 233-A** Statewide Public Boat Access Program. **RSA 270:29** Prohibits motorized watercraft on streams in the White Mountain National Forest. **RSA 270:115 and 120** Specific boating restrictions on the Connecticut River **RSA 270:73-74** Restricts the operation of skicraft. **RSA 270-D:2** General rules for vessels operating on water. **RSA 270:121** Specific restriction on the Piscataquog River **RSA 482-A** Wetlands permit required for dock construction. **RSA 483:9** No motorized watercraft on designated "natural" rivers. On other designated rivers, headway speed only within 150 feet of shore. **Wt 100-800:** NH Wetlands Program rules. **Saf-C-402** Power boat restrictions on specific water bodies. **Saf-C-404** Boating rules. **Saf-C-407** Rafting rules. **Saf-C-413** Water event and slalom course permits.
III B. Camping		**RSA 216-I** Recreational Campgrounds and Camping Parks

Appendix 4. Regulations Affecting the Ashuelot River as a Designated River

TOPIC	FEDERAL	STATE
III C. Trail networking		**RSA 215-A** Off Highway Recreation Vehicle regulations.
III D. Barrier-free access	**American with Disabilities Act (42 USC Chapter 126)**	**RSA 275-C** Governor's Commission on Disabilities.
IV. Wildlife and Fisheries		
IV A. Protection of Wildlife and Fisheries	**Dept. of Transportation Act of 1966: (49 USC 1651-59, Section 4 (f))** No US Dept Transportation projects are allowed on public land important for wildlife, recreation area or wildlife and waterfowl refuge of national, state or local significance or historic properties unless there is no prudent and feasible alternative and there has been all possible planning to minimize harm. **Fish and Wildlife Coordination Act: (16 USC 661-661c)** Whenever a river is altered by a water resource development project, steps should be taken to conserve wildlife resources.	**RSA 207:19-21** Angling and restrictions of fishing.
IV B. Wildlife		**RSA 208** Game animals. **RSA 209** Game birds and pigeons. **RSA 210** Fur-bearing animals. **RSA 212-B** Nongame Species Management Act
IV C. Fisheries		**RSA 211** Fish, shellfish, lobsters and crabs. **RSA 212** Propagation of fish and game. **RSA 213** Atlantic marine fisheries.
V. Rare communities and species		
V A. Unique natural communities; threatened and endangered species	**Endangered Species Act (16 USC 1531-43)**	**RSA 227-C** Governs identification and protection of state historic resources and properties. **RSA 212-A** Endangered Species Conservation Act
VI. Historical and archaeological features		
VI A. Historical Sites	**National Register of Historic Places (16 USC 470a)** **Dept. of Transportation Act of 1966: (49 USC 1651-59, Section 4 (f))** No US Dept Transportation projects are allowed on public land important for wildlife, recreation area or wildlife and waterfowl refuge of national, state or local significance or historic properties unless there I no prudent and feasible alternative and there has been all possible planning to minimize harm. **National Natural Landmarks (16 USC section 463)** In some instances, there may be National Natural Landmarks on some rivers listed on the Nationwide Rivers Inventory.	**RSA 227-C** Governs identification and protection of state historic resources and properties.

Report to the Ashuelot River Local Advisory Committee

Land Use and Soil Conditions Analysis of the Ashuelot River Corridor

March 1998

SWRPC
Southwest Region Planning Commission
20 Central Square, 2nd Floor
Keene, New Hampshire 03431

Appendix 5. Land Use & Soil Conditions

Statement of Purpose

It is a purpose of this analysis to provide a context for discussion of expected demand for development and the risk of degradation of natural and cultural resources due to existing or potential development. Existing land use and soil conditions in the Ashuelot River Corridor were analyzed to provide the Ashuelot River Local Advisory Committee with an understanding of the current and possible future conditions of development in the Corridor. The Committee will use this analysis as part of a planning effort to guide change in the Corridor with a goal of minimizing loss of resources and maximizing resource values.

Approach

Land Use

Land use was inventoried for the project area which is the land area within 1/2-mile of each river bank. The inventory was conducted during Summer 1997. ArcInfo™ Geographic Information System (GIS) was used to quantify the observed land use.

Existing land use was inventoried by field observation during 1997. Identified land uses were recorded on municipal tax maps (a.k.a. parcel maps). Observed land uses were classified using a conventional classification scheme: Single-Family Residential, Commercial, Industrial, Public/Institutional[1], Active Agriculture, Conservation, Other Undeveloped, and Mixed-Use Village Development (several contiguous developed properties, each less than 5 acres). For the purposes of this analysis land use was measured to determine the amount of land currently under the influence of development. The phrase "under the influence of development" means the alteration of natural conditions, principally under the precepts of hydrology and ecology. Alterations may include alteration of topography and drainage patterns, introduction of impervious surfaces and alteration of infiltration and runoff rates, deforestation or other alteration of vegetation, displacement of natural plant and animal communities, and introduction of exotic species or pollutants. Also, the affects of contiguous development were accounted for by quantifying land use of contiguous developed properties differently from single developed properties isolated among undeveloped properties.

The Mixed-Use Village Development class was used to indicate areas of dense residential and/or commercial land use. These areas are generally considered to be potential non-point source pollution threats due to a concentration of household and landscaping chemicals, motor vehicles, and the possibility of other chemicals used in business and industry.

On developed properties less than five acres in size, the land use was ascribed to the entire property, that is the entire property was considered to be under the influence of the type of development observed there. On properties larger than five acres, observed land use was ascribed to an area of influence less than the total property area as either a default of two acres or some other areal extent meant to approximate actual area of influence based on field observation. The two-acre default was typically used for single-family homes in a rural setting.

[1] public/institutional = local, state or federal government uses; or; tax exempt organizational uses, e.g. fraternal organization, church, or historical society

Appendix 5. Land Use & Soil Conditions

The land use inventory and tax maps were automated as GIS data bases. Land use was quantified as acres by class, by count of properties by class, and as a percent of total Corridor land area. The land use inventory was also presented in a map: "Existing Land Use of the Ashuelot River Corridor."

Soil Conditions

Information on soil conditions and other landscape variables that are known to impose limitations on development as reported by the USDA Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service) 1984 Soil Surveys for Cheshire County was analyzed for the study area using ArcInfo™ Geographic Information System. Soil conditions are used here as indicators of limitations to or favorability for future development.

This analysis is based on the NRCS tables that qualify soils for limitations to "Building Site Development," "Sanitary Facilities," and Woodland Management." Each of these tables qualify soil types by an array of subordinate variables as follow:

Building Site Development

Soil	Shallow Excavation	Dwellings without Basements	Dwellings with Basements	Small Commercial Buildings	Local Roads and Streets	Lawns and Landscaping
76B Marlow	Moderate: dense layer	Slight	Moderate: wetness	Moderate: slope	Moderate: frost action	Slight

Sample entry from table 10. Cheshire Co.

NRCS Survey Soil Unit Code and Name. The Unit Code indicates the type of Soil by number (76). There are 264 different soil types in the Corridor. The Code also indicates the slope of land by letter, generally as: A= 0-5%, B= 5-8%, C=8-15%, D=15-25%, E > 25%.

Slight = generally favorable to development; Moderate = some special considerations may be required to overcome limitations; Severe = substantial costs and other special considerations may be required to overcome limitations of soil conditions or site features

These descriptors of soil or site limitations were not used in this analysis.

Sanitary Facilities

Soil	Septic tank absorption field	Sewage lagoon areas
76B Marlow	Severe: percs slowly	Moderate: seepage, slope

Sample entry from table 11. Cheshire Co.

Suitability for lagoons was not used in this analysis.

Appendix 5. Land Use & Soil Conditions

Woodland Management

Soil	Erosion Hazard	Equipment Limitations	Seedling Mortality	Windthrow Hazard	Plant Competition
Sample entry from table 7. Cheshire Co. 75B Marlow	Slight	Slight	Slight	Moderate	Moderate

NOTE: Table 7. Woodland Management and Productivity appearing in the Soil Survey contains fields not shown or used here: Ordination Symbol, Common Trees, Site Index, Productivity Class, and Trees to Plant.

A score was calculated for each soil type for each of the three variables: Building Site Development, Sanitary Facilities, and Woodland Management:

1. Scores were calculated by assigning the values 0, 50, and 100 to the qualifiers slight, moderate, and severe, respectively.
2. Average scores were calculated for each soil type within each table.
3. Average scores for each soil type within each variable were reclassified as slight, moderate or severe using a natural groupings algorithm for each variable as shown below.

Variable	Score	Reclassification
Building Site Development	0 - 50	Slight
	51 - 65	Moderate
	66 - 100	Severe
Sanitary Facilities *	0	Slight
	50	Moderate
	100	Severe
Woodland Management	0 - 20	Slight
	21 - 60	Moderate
	61 - 100	Severe

* Single scores were used here due to soils being qualified for only one subordinate variable: septic tank absorption field.

The qualifiers "slight," "moderate," and "severe" indicate a level of effort required to accomplish the specified activity, such as site development, timber harvest, or installation of a septic absorption field. That effort may be required during or after construction and may include special considerations regarding engineering, construction, maintenance, or cost of a project. These qualifiers may also provide an indication of the level of risk of environmental damage, including loss of soil potential, loss of soil, and contamination of ground or surface waters, as a result of a specified activity. The qualification of a soil type as having slight limitations to building site development does not free a developer from soil erosion control practices before or

after construction and likewise a severe limitation does not mean that construction there is not possible, only that special considerations or precautions will be necessary.

Reclassified soils were analyzed for arial extent as acres and as percent of Corridor land area. The results of this soils analysis were also presented in a map series for the Ashuelot River Corridor.

Findings

The total area of the Ashuelot River Corridor is 52,486 acres. This includes 3,455 acres of surface water (rivers, streams, lakes and ponds) and about 4,069 acres of wetlands, leaving about 44,962 acres of land.

Land Use

The land use inventory revealed that about 51% of the Corridor land area is currently undeveloped. Public and institutional lands was the most extensive land use, occupying 10,405 acres (48% of all developed land) within the Corridor. Residential development occupied 7,438 acres (34% of developed land) with 852 properties involved while Mixed-use village development occupied only 708 acres (4% of developed land) but involved 1,582 properties. Active Agriculture occupied 2,243 acres (10% of developed land) of land on 77 properties. Results of the inventory are shown in Figure 1. and the map: "Ashuelot River Corridor Existing Land Use Summer 1997."

Inspection of the land use inventory map shows that most development occurs within several hundred feet of state and major local roads. Village development tends to be adjacent to the Ashuelot River. Eight of the ten Corridor municipalities have their village centers adjacent to, if not centered on the Ashuelot River, with Washington and Lempster being the exceptions. That part of the City of Keene found within the Corridor represents the largest single extent of Mixed-Use Village Development in the Corridor. West Swanzey, Winchester, and Hinsdale also have well-defined village areas with residential, commercial and industrial land use in the Corridor.

Active agriculture occurs in only several isolated patches of considerable size. Most of the 2,243 acres of active agricultural land in the Corridor is attributable to three areas: hay production in the U.S. Army Corps Surry Mountain Flood Control land; corn and some vegetable production north and west of downtown Keene; hay and pasture on the Brown farm in West Swanzey; and pasture, hay and corn production in Winchester. Scattered small hay fields and pastures are common in the Corridor but represent a small percentage of the Corridor land use and land area.

Public land use accounts for about 48% of the Corridor developed land and 23% of the Corridor land area. These lands include municipal, state and federal property as well as other tax exempt properties such as churches. The Surry Mountain Flood Control reservoir and attendant recreation area represents a considerable part of the lands under public land use. The extent of the City of Keene's public recreation land in the Corridor also warrants notice.

An additional variable investigated in the land use study was the extent and distribution of lands subject to some sort of legalistic restrictions on future development, conventionally known as conservation lands. A query of the NH GRANIT 1994 "Protected Lands" data base provided

information shown in Figure 1. and Figure 2.: 9,474 acres of land in the Corridor are under some sort of conservation restriction, which represents 21% of the total land area. There is caveat about the conservation data to be understood, that being that one category of "protection" in the GRANIT data base is lands under public ownership. Some of those lands are truly conservation lands, such as state and municipal parks. This category also includes lands that are in public ownership for a variety of other reasons and may be subject to development by the public or disposal to private ownership and subsequent development.

Soil Conditions

The soils analysis results are presented in Figure 3. as the number of acres by class and level of limitations, and as percent of total land area by class and level of limitations. NOTE: the land area for the soils analysis is not equivalent to that for the land use study due to the absence of Sullivan County soils data.

The vast majority of land area is considered to have severe limitations to building site development (80%), installation septic tank absorption fields (90%), and woodland management activity (83%). The soils analysis map series illustrates well the vast extent of these restrictions. The presence of high water table, steep slope, shallow bedrock, and/or susceptibility to erosion are the principal environmental factors responsible for the severe limitations.

Land with moderate or slight limitations together represent between 10% and 20% of the Corridor land area. Land with moderate limitations tends to occur in areas that are currently developed, particularly as village areas. Soils with moderate limitations tend to occur on low lying, low relief lands of the valley floor. Soils with slight limitations tend to occur sporadically as isolated patches of 5 to 50 acres.

Summary

The findings of this study indicate that existing development with attendant environmental impacts tends to occur near the Ashuelot River rather than in upland areas within the Corridor. Commercial and industrial development is infrequent outside Village areas. Residential development is evenly distributed along roads in the Corridor, especially from Marlow village south. With this distribution comes equally evenly distributed environmental impacts.

The distribution of existing land use reflects the findings of the soil analysis: much of the Corridor has some limitations to development. Development is concentrated in areas with slight or moderate limitations. Throughout much of the Corridor, large areas currently absent of development are coincidentally known to have limitations to development principally imposed by steep slopes and wetlands.

Measuring the extent and magnitude of existing development and limitations to development imposed by soil conditions should be part of public and private decisions about the appropriateness of land use types and densities throughout the Corridor as well as a being a basis for developing and implementing environmental management tools. For example, the Ashuelot River Local Advisory Committee has identified a need for non-point source pollution prevention

in the Corridor. The findings of this study can be used to work with local officials and property owners to develop prevention measures where an imminent need is identified.

The land use and environmental conditions studied here are sound basic indicators for guiding environmental management decisions and land use controls. There are other equally influential factors which affect existing conditions and will be principal determinants of future development conditions: decision-making of private land owners and the prevailing economic environment. Much of the land area of the upper Corridor is undeveloped and under private ownership as large properties (measured in the 100's and even 1,000's of acres). The fate of privately owned undeveloped land is ultimately in the hands of the owners. None of the information provided in this study indicates that development of currently undeveloped land or increased development densities on currently developed land is impossible. The appropriateness of development and the implementation of land use controls and environmental management tools are public policy decisions and, as such, rely on a shared belief among the general public of a need for control or management.

Appendix 6. Water Quality Monitoring

Ashuelot River Local Advisory Committee Water Quality Monitoring[1]

Volunteers from the Ashuelot River Local Advisory Committee have been monitoring water quality on the Ashuelot River since 2001. The goal of this effort was to provide water quality data from the Ashuelot River relative to surface water quality standards and to allow for the assessment of the river for support of aquatic life and primary contact recreation. The establishment of a long-term monitoring program allows for an understanding of the river's dynamics, or variations on a station-by-station and year-to-year basis. The data can also serve as a baseline from which to determine any water pollution problems in the river and/or watershed. The Volunteer River Assessment Program has provided field training, equipment, financial assistance, and technical assistance.

Trained volunteers from the Ashuelot River Local Advisory Committee monitored water quality at ten sites along the mainstem of the Ashuelot River from its upper limits in Washington to just upstream of its confluence with the Connecticut River in Hinsdale (Figure 1, Table 1). Stations ID's are designated using a three letter code to identify the waterbody name plus a number indicating the relative position of the station. The higher the station number the more upstream the station is in the watershed. All stations monitored are designated as Class B waters.

Water quality monitoring was conducted monthly from May to September. In-situ measurements of water temperature, air temperature, dissolved oxygen, pH, and specific conductance were taken using handheld meters funded by the Connecticut River Joint Commission. Turbidity samples were collected in the field, brought to a central location and measured the same day using a handheld meter. Samples for *E.coli* and total phosphorous were taken using sterile and/or preserved bottles and were stored on ice during transport from the field to the lab. Results from 2001-2005 water quality monitoring are found in Tables 3-12.

Tested Parameters:

1. Dissolved Oxygen (DO)

Unit of Measurement: concentration (milligrams per liter) and saturation (percent); (abbreviated as mg/L and %, respectively).

Description: A measure of the amount of oxygen in the water: Concentration is a measure of the amount of oxygen in a volume of water; saturation is a measurement of the amount of oxygen in the water compared to the amount of oxygen the water can actually hold at full saturation. Both of these measurements are necessary to accurately determine whether New Hampshire surface water quality standards are met.

Importance: Oxygen is dissolved into the water from the atmosphere, aided by wind and wave action or from rocky, steep, or uneven stream beds. Aquatic plants and algae produce oxygen in the water during the day, but consume oxygen during the night. Bacteria utilize oxygen (day and night) as they process organic matter deposited in the river into smaller and smaller particles.

Class B NH Surface Water Quality Standard: 5 mg/L at any place or time or 75% minimum daily average – unless naturally occurring.

[1] New Hampshire Volunteer Assessment Program: 2005 Ashuelot River Water Quality Report. NH Department of Environmental Services, January 2006.

Appendix 6. Water Quality Monitoring

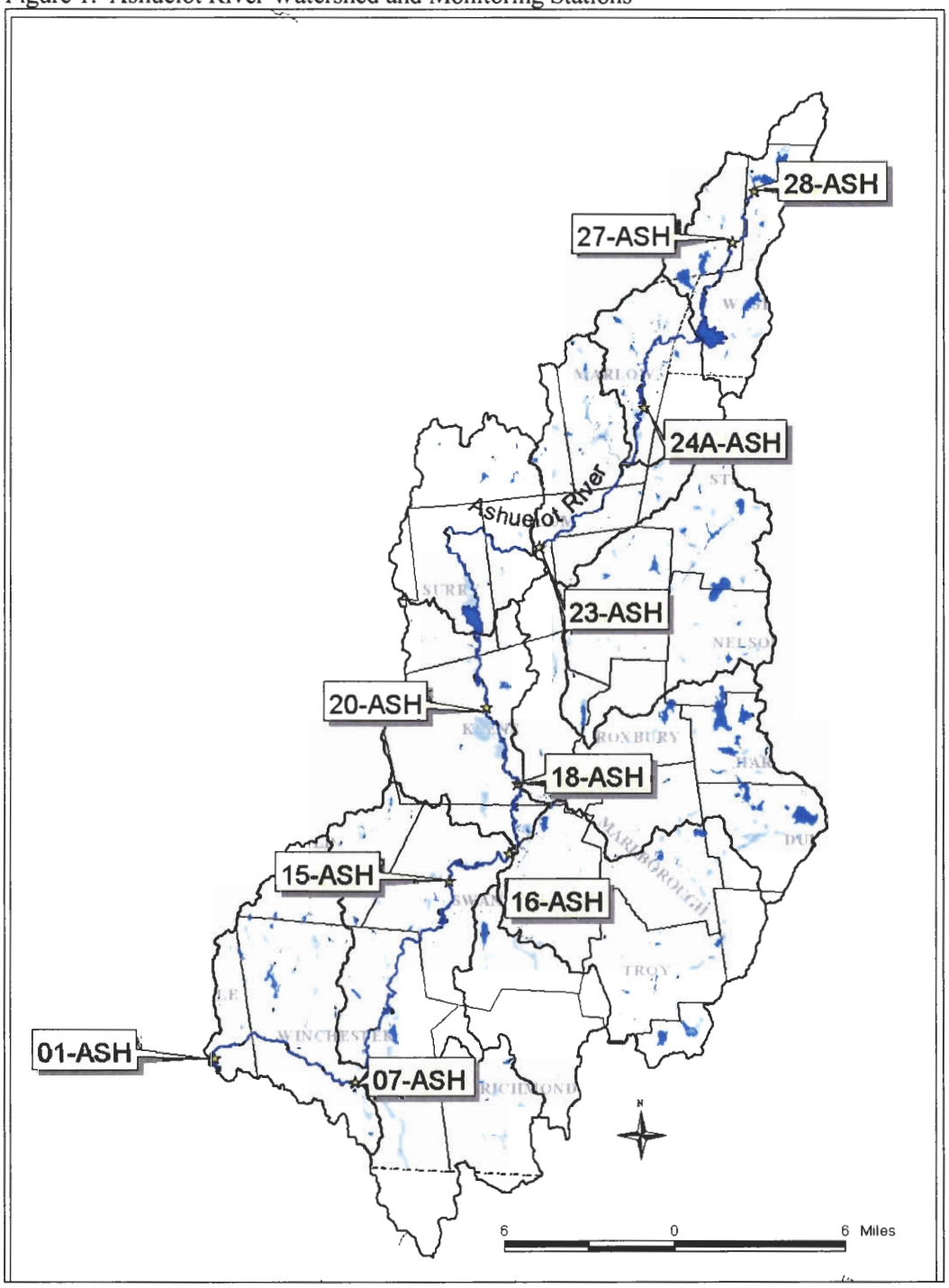
Table 1. Sampling Stations for the Ashuelot River

Station ID	Location	Town	Elevation*
28-ASH	Route 31	Washington	1600
27-ASH	Mountain Road	Lempster	1500
24A-ASH	Route 10	Marlow	1100
23-ASH	Route 10	Gilsum	800
20A-ASH	Stone Arch Bridge	Keene	500
18-ASH	Route 101	Keene	500
16-ASH	Cresson Bridge	Swanzey	500
15-ASH	Thompson Bridge	West Swanzey	400
07-ASH	Route 119	Winchester	400
01-ASH	147 River Street	Hinsdale	200

*Elevations have been rounded off to 100-foot increments for calibration of dissolved oxygen meter

Appendix 6. Water Quality Monitoring

Figure 1. Ashuelot River Watershed and Monitoring Stations



Several measurements of oxygen saturation taken in a 24-hour period must be averaged to compare to the 75 percent daily average saturation standard. The concentration of dissolved oxygen is dependent on many factors including temperature and sunlight, and tends to fluctuate throughout the day. Saturation values are averaged because a reading taken in the morning may be low due to respiration, while a measurement that afternoon may show that the saturation has recovered to acceptable levels. Water can become saturated with more than 100 percent dissolved oxygen.

2. pH

Unit of Measurement: units (no abbreviation)

Description: A measure of hydrogen ion activity in water, or, in general terms, the acidity of water. pH is measured on a logarithmic scale of 0 to 14 with 7 being neutral. A high pH is indicative of an alkaline or basic environment and a low pH is indicative of an acidic environment. pH is influenced by geology and soils, organic acids (decaying leaves and other matter), and human-induced acids from acid rain (which typically has a pH of 3.5 to 5.5).

Importance: pH is important to the survival and reproduction of fish and other aquatic life. A pH of below 5.0 severely limits the growth and reproduction of fish. pH also affects the toxicity of other aquatic compounds such as ammonia and certain metals.

Class B NH Surface Water Quality Standard: Between 6.5-8.0, unless naturally occurring.

Sometimes, readings that fall below this range are determined to be naturally occurring, perhaps because of the influence of wetlands near the sample station. This is due to the presence or release of tannic and humic acids by decaying plants, which can create more acidic waters in areas influenced by wetlands.

pH (Units)	Category
<5.0	High Impact
5.0 – 5.9	Moderate to High Impact
6.0 – 6.4	Normal; Low Impact
6.5 – 8.0	Normal;
6.1 – 8.0	Satisfactory

3. Conductivity or Specific Conductance

Unit of Measurement: micromhos per centimeter or microsiemens per centimeter (abbreviated as umhos/cm or uS/cm, respectively.

Description: The numerical expression of the ability of water to carry an electrical current at 25° C, and is a measurement of free ion (charged particles) content in the water. These ions can come from natural sources such as bedrock, or human sources such as stormwater runoff. Specific conductance can be used to indicate the presence of chlorides, nitrates, sulfates, phosphates, sodium, magnesium, calcium, iron, and aluminum ions. The difference between conductivity and

specific conductance is specific conductance accounts for the actual water temperature rather than 25° C. The term "specific conductance" is used in the VRAP because the actual measurement is of the *conductivity* (or electric current) at a *specific* water temperature. In some studies and programs, the term "conductivity" is used. This term should only be used when the measurement *does not* adjust to a specific temperature.

Importance: Specific conductance readings are useful in locating potential pollution sources because polluted waters usually have higher specific conductance than unimpaired surface waters. High specific conductance values may indicate pollution from sources such as road salting, septic systems, wastewater treatment plants, or urban/agricultural runoff.

Class B NH Surface Water Quality Standard: No numeric standard.

In New Hampshire, there is no standard for specific conductance, because levels naturally vary a great deal according to the geology of an area. Mountain streams typically have low conductivity and freshwater coastal streams typically have higher conductivity.

Unit	Category
0 – 100	Normal
101 – 200	Low Impact
201 – 500	Moderate Impact
> 501	High Impact

4. Turbidity

Unit of Measurement: Nephelometric Turbidity Units (abbreviated at NTU)

Description: A measurement of the amount of suspended material in the water, such as clay, silt, algae, suspended sediment, and decaying plant material.

Importance: A high degree of turbidity can scatter the passage of light through the water and inhibit light from reaching important areas. Clean waters are generally associated with low turbidity, but there is a high degree of natural variability involved. Rain events often contribute turbidity to surface waters by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters.

Class B NH Surface Water Quality Standard: Shall not exceed naturally occurring conditions by more than 10 NTU.

5. Escherichia Coliform Bacteria (*E. coli*)

Unit of Measurement: Counts per 100 mL (abbreviated as cts/100 mL)

Description: An indicator of the potential presence of pathogens in fresh water. *E. coli* bacteria is a normal component in the large intestines of humans and other warm-blooded animals, and can be excreted in their fecal material. Organisms causing infections or disease (pathogens) are often excreted in the fecal material of humans and other warm-blooded animals.

Importance: *E.coli* bacteria is a good indicator of fecal pollution and the possible presence of pathogenic organisms. In freshwater, *E. coli* concentrations help determine if the water is safe for recreational uses such as swimming.

Class B NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 126 E. coli cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 406 E. coli cts/100 mL in any one sample.

6. Total Phosphorus (TP)

Unit of Measurement: Milligrams/liter (abbreviated as mg/L)

Description: A measure of all forms of phosphorus in the water, including inorganic and organic forms. Phosphorus is usually the limiting nutrient in freshwater streams, which means relatively small amounts of phosphorus can determine the amount of planktonic algae that will grow in the river. High phosphorus can increase the amount of algae and chlorophyll-a levels in the river. Phosphorus can indicate the presence of sewage, animal waste, fertilizer, erosion, or other types of pollution.

Importance: Phosphorus is a nutrient that is essential to plants and animals, however, in excess amounts can cause rapid increases in the biological activity in water. This may disrupt the ecological integrity of streams and rivers. For example, excess phosphorus can trigger nuisance algal blooms and aquatic plant growth, which can decrease oxygen levels and the attractiveness of waters for recreational purposes. High phosphorus levels can be an indicator of sewage, animal manure, fertilizer, erosion, and other types of contamination.

Class B NH Surface Water Quality Standard: No numeric standard; unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses.

Unit	Category
< 0.010	Ideal
0.011 – 0.025	Average
0.026 – 0.050	More than desirable
> 0.051	Excessive (potential nuisance concentration)

7. Chloride

Unit of Measurement: Milligrams per liter (abbreviated mg/L)

Description: The chloride ion (Cl^-) is found naturally in some surface waters and groundwater and in high concentrations in seawater. Higher-than-normal chloride concentrations in freshwater, due to sodium chloride (table salt) that is used on foods and present in body wastes, can indicate sewage pollution. The use of highway deicing salts can also introduce chlorides to surface water or ground water. Elevated groundwater chlorides in drinking water wells near coastlines may indicate saltwater intrusion.

In New Hampshire, the application of road salt for winter accident prevention is a large source of chloride to the environment, which is increasing over time due to the expansion of road networks and increased vehicle traffic. Road salt (most often sodium chloride) readily dissolves and enters aquatic environments in ionic forms. Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans.

Importance: Research shows that elevated chloride levels can be toxic to freshwater aquatic life. Among the species tested, freshwater aquatic plants and invertebrates tend to be the most sensitive to chloride. In order to protect freshwater aquatic life in New Hampshire, the state has adopted acute and chronic chloride criteria.

Acute Standard: Acute toxicity means an adverse effect such as mortality or debilitation caused by an exposure of 96 hours or less to a toxic substance (i.e.; short period of time). The acute standard is 280 mg/L.

Chronic Standard: Chronic toxicity means an adverse effect such as reduced reproductive success or growth, or poor survival of sensitive life stages, which occurs as a result of prolonged exposure to a toxic substance (i.e.; long period of time). The chronic standard is 230 mg/L.

8. Metals

Depending on the metal concentration, its form (dissolved or particulate), and the hardness of the water, trace metals can be toxic to aquatic life. Metals in dissolved form are generally more toxic than metals in the particulate form. The dissolved metal concentration is dependent on the pH of the water, as well as the presence of solids and organic matter that can bind with the metal to render it less toxic.

Hardness is primarily a measure of the calcium and magnesium ion concentrations in water, expressed as calcium carbonate. The hardness concentration affects the toxicity of certain metals. New Hampshire water quality regulations include numeric criteria for a variety of metals. Since dissolved metals are typically found in extremely low concentrations, the potential contamination of samples collected for trace metals analyses has become a primary concern of water quality managers. To prevent such contamination and to ensure reliable results, the use of "clean techniques" is becoming more and more frequent when sampling for dissolved metals. Because of this, sampling for metals may be more costly and require additional effort than in the past.

Ashuelot River Local Advisory Committee River Monitoring Results 2001-2005[2]

[2] Compiled from ARLAC raw field data, NHDES VRAP annual Ashuelot River Water Quality Reports 2001-2005, and data analysis presented annually by D. Hanscom, Keene WWTP.

Appendix 6. Water Quality Monitoring

After 5 years of river monitoring we are able to determine that there are detectable trends along the length of the river, with seasonal variation, and that the tributaries do have an impact on the water quality in the river. However, when findings exceed the water quality standards, it remains difficult to identify the sources of the likely pollution. Rain events do have an impact, lending to the belief that non-point sources are a large contributing factor in the Ashuelot River water quality.

For Class B rivers, the NH standard daily average for Dissolved Oxygen (DO) must be at least 75%. August was the only month when findings on the Ashuelot dipped below this standard at the Pillsbury site, once in 2001 and again in 2002. Sites in Keene and downstream to the Thompson Covered Bridge in Swanzey also dipped below 75% standard daily average, mostly occurring in 2002. That year, after Keene State College boiler condensation was redirected from storm water pipes to the sewer, the DO numbers returned to above the standard (Table 2).

The pH value found in the river is generally lower than the EPA standard, which is 6.5-8 unless due to natural causes. In the Ashuelot the pH starts low at the Pillsbury site with an average of 5.8 and a range of 5.48-6.58. As the river flows downstream the pH rises but remains below 8. The EPA lists the Ashuelot River as "Impaired" due to the low pH readings. However, lower pH can be the result of natural conditions such as soils, geology or the presence of wetlands in the area. In the Ashuelot, the lower readings are located at the upper reaches where there is the influence of wetlands as well as less buffering provided by the soils there. The release of tannic and humic acids from decayed plant material in the wetlands can naturally lower the pH of the river. Rain and snowfall in NH is relatively acidic and this would influence pH after significant rain or snowmelt (Table 3).

While the turbidity levels of the Ashuelot have been well within the NH surface water quality standard for Class B waters (<10 NTUs above naturally occurring conditions), there is an increase as the river moves downstream into the more developed areas. Human activities such as the removal of vegetation near surface waters and disruption of nearby soils can also lead to dramatic increases in turbidity levels. There was one slight rise in turbidity after a large rain event in Sept. 2004, reflecting the effect precipitation can have by flushing sediment, organic matter and other materials from the surrounding landscape into the river (Table 4).

The amount of precipitation can also influence the levels of bacteria detected in the river. *Escherichia coli* (*E.coli*) levels were found to be highest in the month of September, also a month with higher rainfall. August and July, months with less rainfall, followed as months with higher readings. Based on the geometric mean of samples taken July through September of 2005, sites located at Rte 101 and the Cresson Bridge violated Class B water quality standards. These sites also tended to show higher individual readings throughout the sampling period, with 17% of the samples over the 5 years exceeding 406 colonies/100 milliliters. However, it must be kept in perspective that the majority of the 31samples taken at each site were below this standard and that the river for the most part maintains its Class B rating. Sites located in Pillsbury, Marlow, and the Stone Arch Bridge in Keene never exceeded the standard. Over the next two years, the City of Keene will implement a project to identify sources of bacterial contamination in Beaver Brook, a tributary known to contribute to the bacteria problem in the Ashuelot (Table 5).

Appendix 6. Water Quality Monitoring

As the river moves from a more rural setting to more developed surroundings, the potential for pollution from run-off increases. While generally low throughout the course of the river, specific conductance readings increase as water flows downstream. Readings ranged from 14-227.7 µS/cm, with only 10 readings above 200, indicating generally low impact to the river. Six of the ten occurred in September 2002 at sites in Keene and downstream, coinciding with low river flows (Table 6).

Chloride was measured in samples in 2001 and 2002 and generally revealed low levels except for these same sites in September 2002 where the chloride measured 30-45mg/L. Chloride testing was discontinued in 2003 as the Class B surface water quality standard is 230mg/L for chronic condition, and 860mg/L for acute occurrence (Table 7).

Also noted downstream of Keene was the increase in total phosphorus (Table 8). Readings from the whole river over the five years ranged from .005 - .236 mg/L with the largest readings most frequently detected at the Cresson and Thompson Covered Bridges, both downstream of the Keene Wastewater Treatment Plant. The Keene WWTP is awaiting their updated discharge permit from the EPA which will dictate the level of phosphorus that can be discharged into the Ashuelot. The Keene WWTP is prepared to retool to meet the new discharge limit.

ARLAC tested for four metals in 2001, cadmium, copper, lead and zinc (Tables 9-12). Levels for lead, cadmium and zinc were well below NH water quality criteria for acute and chronic occurrence in surface waters. Copper was detected at levels 2.77 - 6.29 ug/L in 8 instances. Only copper was tested in 2002, and detected only in August at levels of 5.1, 3.2, and 2.8 ug/L respectively at sites Rte 101, Cresson Covered Bridge and Thompson Covered Bridge. It is planned to repeat testing of all four metals in 2006.

Table 2- Dissolved Oxygen (% sat.)

NH Standard: greater than 75%

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH	
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St	
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale	Mean
2001	May	N/A	N/A	N/A	N/A	88.600	87.700	85.300	N/A	N/A	N/A	87.200
	June	N/A	N/A	N/A	N/A	87.4	87.0	82.5	N/A	N/A	N/A	85.633
	July	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	August	N/A	N/A	N/A	N/A	66.2	70.7	70.8	N/A	N/A	N/A	69.233
2002	May	93.0	92.4	95.5	96.4	81.6	80.1	77.6	93.2	99.1	96.4	90.530
	June	93.1	94.8	95.0	97.1	88.5	96.1	90.5	88.4	91.4	99.3	93.420
	July	90.20	89.50	97.30	101.70	73.60	71.80	71.80	103.80	92.50	100.90	89.310
	August	64.20	91.90	80.60	94.00	68.40	45.70	58.80	113.60	82.60	100.50	80.030
2003	May	80.7	80.6	83.4	98.6	78.2	75.3	79.1	82.9	92.6	96.5	84.790
	June	80.8	86.5	89.8	94.5	76.3	77.6	81.2	76.6	80.1	92.5	83.590
	July	N/A	N/A	N/A	N/A	73.5	71.7	75.5	82.2	97.3	97.5	82.950
	August	85.3	85.0	85.8	93.6	81.5	90.3	89.5	87.2	85.7	94.5	87.840
	Sept	82.8	82.7	92.6	97.2	79.9	81.5	78.4	79.9	83.9	94.8	85.370
2004	May	76.0	81.4	85.7	91.1	79.9	80.5	77.5	71.0	77.3	91.1	81.150
	June	83.5	85.6	91.1	96.6	83.0	83.2	83.2	80.2	81.8	89.0	85.719
	July	80.9	83.7	85.3	93.0	82.7	82.7	81.3	73.7	82.4	97.0	84.270
	August	78.8	78.1	84.1	87.3	83.5	84.6	81.6	80.2	78.7	95.0	83.190
	Sept	84.8	85.1	84.0	90.1	86.8	86.5	85.2	77.8	78.0	89.0	84.730
2005	May	87.2	89.9	92.6	99.2	82.5	76.9	83.2	87.1	89.3	96.4	88.430
	June	86.7	87.8	88.6	93.0	86.9	88.1	85.8	85.3	86.2	94.1	88.250
	July	81.2	79.2	85.1	86.1	74.4	80.1	78.8	80.1	81.1	94.2	82.030
	August	82.1	83.6	84.1	84.7	76.4	79.5	78.3	83.6	82.1	90.1	82.450
	Sept	81.2	85.8	83.3	80.3	77.4	74.2	73.0	67.1	78.2	94.0	79.450
Mean		**82.917**	**85.756**	**87.994**	**93.028**	**79.873**	**79.627**	**79.495**	**83.889**	**85.279**	**94.884**	85.274
Max		**93.100**	**94.800**	**97.300**	**101.700**	**88.600**	**96.100**	**90.500**	**113.600**	**99.100**	**100.900**	97.570
Min		**64.200**	**78.100**	**80.600**	**80.300**	**66.200**	**45.700**	**58.800**	**67.100**	**77.300**	**89.000**	70.730

= sample does not meet NH standards of >75%

Table 3- pH

NH Standard: 6.5-8

pH		Site	1	1.5	2	3	4	5	6	7	8	9	
Year	Month	Month	Pillsbury	Mt Road	Marlow	Gilsum	Stone Ar	Rt 101	Cresson	Thompson	Winchester	Hinsdale	Mean
2001	5	May	6.58	5.96	6.08	6.51	6.21	6.24	6.5	6.44	6.34	6.39	6.28
	6	June	5.73	5.47	5.61	6.16	5.82	6.29	6.19	6.61	6.97	6.46	5.93
	7	July	5.9	5.79	6.06	6.3	5.55	6.37	6.2	7.27	6.63	6.63	6.06
	8	August	5.76	5.66	5.93	6.58	5.98	6.26	6.32	6.85	6.84	7.38	6.11
2002	5	May	5.74	5.59	5.69	6.18	6.1	5.58	5.7	6.89	6.45	6.62	5.88
	6	June	5.69	5.69	5.86	5.9	6.43	6.66	6.64	6.38	6.21	6.35	6.04
	7	July	6.33	5.69	6.35	6.88	6.86	6.65	6.83	6.99	7.03	7.76	6.42
	8	August	6.05	5.98	6.25	7.03	6.65	6.52	6.29	7.3	6.84	7.42	6.41
2003	5	May	5.73	5.64	5.83	6.14	6.41	6.39	6.69	6.58	6.52	7.23	6.10
	6	June	5.97	5.78	6.16	6.55	6.58	6.49	6.64	6.53	6.67	7.36	6.29
	7	July	5.48	5.53	5.69	6.2	6.76	6.59	6.64	6.46	6.67	6.93	5.99
	8	August	5.83	5.47	5.53	5.81	6.04	6.01	6.2	5.79	5.94	6.3	5.82
	9	Sept	6	5.89	5.86	6.61	5.92	6.2	6.09	6.53	5.9	6.26	6.06
2004	5	May	5.85	5.68	6.59	6.41	6.36	6.42	6.39	6.49	6.15	6.86	6.18
	6	June	5.84	5.9	6.17	6.41	6.37	6.4	6.44	6.37	6.34	6.55	6.21
	7	July	5.99	5.94	6.08	6.34	6.53	6.44	6.55	6.99	6.56	6.7	6.30
	8	August	6.05	5.75	5.79	6.22	6.47	6.47	6.46	6.31	6.43	6.53	6.15
	9	Sept	6.14	5.94	6.21	6.21	6.55	6.42	6.61	6.48	6.65	6.75	6.32
2005	5	May	5.75	5.75	5.82	6.33	6.25	6.3	6.12	5.91	6.15	5.97	5.98
	6	June	5.69	5.3	5.56	5.81	6.3	6.41	6.48	6.31	6.27	6.26	5.85
	7	July	5.59	5.5	5.7	6.31	6.35	6.25	6.44	6.41	6.28	6.83	5.97
	8	August	5.69	5.58	5.86	6.1	6.41	6.47	6.56	6.45	6.36	6.76	6.05
	9	Sept	5.61	6	5.95	6.1	6.4	6.32	6.29	6.34	6.59	6.95	6.12
Mean			5.87	5.72	5.94	6.31	6.32	6.35	6.40	6.55	6.47	6.75	
Max			6.58	6	6.59	7.03	6.86	6.66	6.83	7.3	7.03	7.76	6.42
Min			5.48	5.3	5.53	5.81	5.55	5.58	5.7	5.79	5.9	5.97	5.82

sample does not meet NH Standard

Table 4- Turbidity (NTUs)

NH Standard: <10 NTU above background

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH	
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St	
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale	Mean
2001	May	0.35	N/A	0.70	0.40	0.65	0.60	0.90	1.50	1.00	0.90	0.778
	June	0.30	N/A	0.75	0.45	0.90	1.00	1.80	1.60	1.60	1.20	1.067
	July	0.0	N/A	0.5	N/A	0.5	0.9	1.9	1.3	1.3	2.0	1.050
	August	0.35	N/A	0.65	0.25	1.00	2.10	2.30	1.70	1.10	0.80	1.139
2002	May	0.00	0.00	0.35	0.25	0.65	1.10	1.00	0.86	0.85	1.00	0.606
	June	0.20	0.15	0.60	0.45	0.65	1.00	1.60	1.90	1.30	1.50	0.935
	July	0.80	0.90	0.35	0.95	0.65	1.00	1.60	1.80	1.20	0.95	1.020
	August	0.10	0.05	0.00	0.95	0.70	5.8	2.4	1.2	2.1	0.30	1.360
2003	May	0.50	0.85	0.05	0.00	0.70	1.20	1.80	1.40	0.75	0.20	0.745
	June	0.05	0.00	0.30	0.25	0.85	1.00	1.10	0.80	1.60	1.20	0.715
	July	0.25	0.15	0.15	0.25	0.40	0.00	1.50	2.00	0.75	1.10	0.655
	August	0.90	1.10	0.75	0.45	1.00	2.80	3.50	4.90	3.20	4.50	2.310
	Sept	0.15	0.05	0.20	0.35	0.45	1.00	1.88	1.90	1.09	1.02	0.809
2004	May	0.65	0.30	0.10	0.10	1.40	1.40	1.90	1.40	1.40	1.30	0.995
	June	0.45	0.35	0.60	0.80	0.75	1.00	1.50	1.80	1.30	1.00	0.955
	July	0.40	0.20	0.30	0.10	0.60	3.20	2.40	1.90	1.50	1.30	1.190
	August	0.50	0.50	0.15	3.70	1.00	1.30	4.60	1.60	3.60	2.00	1.895
	Sept	0.60	3.60	0.55	6.80	3.10	3.60	13.00	4.70	3.80	3.00	4.275
2005	May	0.00	0.00	0.40	0.10	0.40	0.55	0.90	1.00	0.65	0.60	0.460
	June	0.15	1.70	1.50	1.00	2.70	2.00	2.50	3.50	2.70	2.40	2.015
	July	0.05	0.50	0.75	0.45	0.40	1.50	2.10	2.00	1.20	2.30	1.125
	August	0.20	0.05	1.10	0.30	0.55	1.40	1.40	1.90	1.20	1.20	0.930
	Sept	0.05	0.25	0.25	0.45	0.65	1.00	2.60	1.60	1.50	1.20	0.955
Mean		**0.304**	**0.563**	**0.480**	**0.855**	**0.898**	**1.585**	**2.443**	**1.924**	**1.595**	**1.433**	1.208
Max		**0.900**	**3.600**	**1.500**	**6.800**	**3.100**	**5.800**	**13.000**	**4.900**	**3.800**	**4.500**	4.790
Min		**0.000**	**0.000**	**0.000**	**0.000**	**0.400**	**0.000**	**0.900**	**0.800**	**0.650**	**0.200**	0.295

Table 5- E. coli (colonies per 100mL)

NH Standard: limit of 406 colonies per 100 mL

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH	
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St	
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale	Mean
2001	May	1	N/A	6	20	6	33	28	19	20	51	20
	June	1	N/A	19	26	19	51	120	61	47	57	45
	July	10	N/A	6	16	44	92	86	87	48	52	49
	August	56	N/A	6	8	75	1080	140	176	70	40	183
2002	May	1	1	2	12	3	108	50	22	48	62	31
	June	1	6	22	32	8	28	60	117	50	89	41
	July	14	N/A	40	200	107	410	920	110	116	152	230
	August	24	50	50	440	80	1000	197	166	2020	220	425
2003	June	N/A	26	34	20	34	155	210	185	70	73	90
	July	3	42	6	25	96	146	135	65	109	69	70
	August	6	20	12	20	22	48	78	66	46	66	38
	Sept	4	1	6	10	11	73	77	102	24	80	39
2004	May	1	7	10	14	30	106	52	54	80	66	42
	June	6	8	8	10	48	67	120	63	126	57	51
	July	1	7	10	8	22	126	227	50	90	60	60
	August	N/A	N/A	N/A	16	N/A	116	190	33	30	60	74
	Sept	20	1460	115	740	350	873	1840	1060	713	2020	919
2005	May	4	1	1	10	4	34	24	14	32	30	15
	June	18	44	54	46	60	48	124	150	203	900	165
	July	30	22	20	22	250	121	217	64	133	310	119
	August	4	14	14	50	25	164	88	53	73	27	51
	Sept	14	38	42	83	63	122	2000	80	160	128	273
Mean		**11**	**109**	**23**	**83**	**65**	**227**	**317**	**127**	**196**	**212**	**138**
Median		**5**	**17**	**12**	**20**	**34**	**112**	**122**	**66**	**72**	**66**	**56**
Max		**56**	**1460**	**115**	**740**	**350**	**1080**	**2000**	**1060**	**2020**	**2020**	**919**
Min		**1**	**1**	**1**	**8**	**3**	**28**	**24**	**14**	**20**	**27**	**15**

= sample exceeds NH Standard

Table 6- Conductivity (µS)*

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH	
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Arch	Rt 101	Cresson	Thompson	Rt 119	147 River St	
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale	Mean
2001	May	22.1	30.1	31.6	46.5	64.2	83.3	94.3	128.4	124.7	126.6	75.2
	June	23.0	25.0	29.2	34.2	44.6	52.6	75.2	69.2	51.7	54.4	45.9
	July	24.8	32.1	33.3	47.8	66.0	101.0	117.8	120.0	110.0	120.0	77.3
	August	34.8	31.3	43.8	70.3	90.9	202.9	199.6	195.0	169.0	167.0	120.5
2002	May	28.4	31.5	39.4	42.2	45.9	56.5	77.6	70.8	70.7	68.0	53.1
	June	24.7	32.4	37.0	44.9	54.1	74.0	99.1	96.8	92.6	97.8	65.3
	July	33.8	43.1	47.3	62.0	77.1	145.4	195.5	204.1	172.2	168.4	114.9
	August	38.7	39.8	51.6	110.3	105.7	117.0	109.6	227.7	162.3	180.5	114.3
2003	May	29.6	41.5	40.1	47.6	59.1	78.7	104.8	101.1	99.6	96.4	69.9
	June	32.0	39.3	45.7	64.1	77.2	137.8	141.6	138.3	118.1	118.0	91.2
	July	35.2	47.4	53.0	74.7	87.2	178.8	146.9	147.6	158.9	148.8	107.9
	August	22.9	29.4	41.6	42.2	43.9	46.7	61.8	59.3	60.8	60.1	46.9
	Sept	30.1	43.9	38.2	55.0	72.3	99.8	127.4	136.1	114.4	109.3	82.7
2004	May	29.1	32.6	48.8	48.8	58.4	91.9	101.6	96.9	90.2	91.0	68.9
	June	28.3	34.6	40.2	54.5	67.0	116.1	125.6	138.7	124.1	125.1	85.4
	July	29.0	36.0	47.5	59.3	78.5	160.3	148.5	138.0	136.1	133.9	96.7
	August	26.0	40.5	33.4	47.3	62.7	81.6	102.0	104.5	90.4	90.7	67.9
	Sept	24.1	46.9	35.6	36.9	55.5	76.4	98.1	108.9	89.2	93.8	66.5
2005	May	28.0	34.8	37.0	48.2	62.1	99.5	112.7	115.5	112.4	111.4	76.2
	June	24.6	31.6	30.8	34.1	47.2	46.8	75.7	78.7	86.7	87.4	54.4
	July	24.8	30.2	36.7	45.4	58.3	106.9	105.5	105.5	95.7	89.8	69.9
	August	24.6	31.3	47.3	59.7	67.3	119.1	126.7	123.3	113.6	109.7	82.3
	Sept	24.1	32.4	36.1	49.7	59.9	120.6	175.2	192.9	154.7	153.6	99.9
Mean		**27.9**	**35.6**	**40.2**	**53.3**	**65.4**	**104.1**	**118.4**	**126.0**	**113.0**	**113.1**	**79.7**
Max		**38.7**	**47.4**	**53.0**	**110.3**	**105.7**	**202.9**	**199.6**	**227.7**	**172.2**	**180.5**	**120.5**
Min		**22.1**	**25.0**	**29.2**	**34.1**	**43.9**	**46.7**	**61.8**	**59.3**	**51.7**	**54.4**	**45.9**

* New Hampshire surface water quality standards do not contain numeric limits for conductivity

Table 7- Chloride (mg / L)

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale
2001	May	5	n/a	5	10	20	20	25	25	25	25
	June	5	n/a	5	5	5	10	15	15	15	15
	July	5	n/a	5	10	10	20	25	25	20	20
	August	3	n/a	5	10	10	40	30	35	25	30
	May	5	0	5	5	5	10	10	15	10	10
2002	June	<5	5	5	5	10	15	20	20	15	20
	July	5	5	10	10	10	30	45	40	35	35
	August	5	10	5	20	15	65	50	50	30	40
	September	10	10	15	25	15	55	45	40	45	45
Mean		**5.38**	**6.00**	**6.67**	**11.11**	**11.11**	**29.44**	**29.44**	**29.44**	**24.44**	**26.67**
Max		**10.00**	**10.00**	**15.00**	**25.00**	**20.00**	**65.00**	**50.00**	**50.00**	**45.00**	**45.00**
Min		**3.00**	**0.00**	**5.00**	**5.00**	**5.00**	**10.00**	**10.00**	**15.00**	**10.00**	**10.00**

Table 8- Total Phosphorus (mg / L)*

NH Level of Concern: >0.05 mg / L

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH	
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St	
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale	Mean
2001	May	0.006	N/A	0.005	<0.005	0.007	0.007	0.051	0.057	0.021	0.018	0.019
	June	0.008	N/A	0.015	0.010	0.013	0.013	0.038	0.039	0.031	0.033	0.022
	July	0.008	N/A	0.010	0.011	0.011	0.012	0.080	0.089	0.059	0.056	0.037
	August	0.010	N/A	0.011	0.007	0.013	0.012	0.154	0.162	0.072	0.053	0.055
2002	May	0.005	0.006	0.007	0.005	0.012	0.010	0.026	0.021	0.025	0.025	0.014
	June	0.006	0.007	0.008	0.009	0.008	0.010	0.042	0.047	0.034	0.027	0.020
	July	0.020	0.024	0.017	0.016	0.013	0.021	0.109	0.144	0.050	0.045	0.046
	August	0.006	0.009	0.005	0.007	0.010	0.020	0.203	0.041	0.040	0.236	0.058
2003	May	0.008	N/A	0.006	0.006	0.008	0.012	0.028	0.035	0.041	0.023	0.019
	June	N/A	0.013	0.009	0.011	0.009	0.014	0.089	0.108	0.050	0.045	0.039
	July	0.007	0.022	0.011	0.010	0.008	0.016	0.097	0.092	0.082	0.068	0.041
	August	0.010	0.011	0.011	0.014	0.020	0.020	0.031	0.038	0.042	0.046	0.024
	Sept	<0.005	0.008	<0.005	<0.005	0.005	0.008	0.094	0.130	0.068	0.041	0.036
2004	May	0.005	N/A	0.006	0.007	0.007	0.007	0.017	0.039	0.038	0.028	0.017
	June	0.007	0.010	0.008	0.009	0.011	0.012	0.055	0.081	0.042	0.039	0.027
	July	0.007	0.010	0.008	0.010	0.010	0.019	0.083	0.077	0.062	0.059	0.035
	August	0.006	0.009	0.008	0.028	0.019	0.020	0.063	0.069	0.049	0.045	0.032
	Sept	0.008	0.017	0.013	0.042	0.018	0.022	0.091	0.105	0.058	0.050	0.042
2005	May	0.019	0.015	0.016	0.012	0.020	0.021	0.042	0.051	0.040	0.055	0.029
	June	0.026	0.019	0.015	0.014	0.022	0.016	0.033	0.035	0.043	0.046	0.027
	July	0.013	0.016	0.014	0.018	0.014	0.018	0.061	0.067	0.045	0.041	0.031
	August	0.014	0.009	0.012	0.010	0.009	0.012	0.046	0.046	0.041	0.029	0.023
	Sept	0.011	0.017	0.009	0.009	0.012	0.018	0.102	0.150	0.066	0.057	0.045
Mean		**0.010**	**0.013**	**0.010**	**0.013**	**0.012**	**0.015**	**0.071**	**0.075**	**0.048**	**0.051**	**0.032**
Max		**0.026**	**0.024**	**0.017**	**0.042**	**0.022**	**0.022**	**0.203**	**0.162**	**0.082**	**0.236**	**0.058**
Min		**0.005**	**0.006**	**0.005**	**0.005**	**0.005**	**0.007**	**0.017**	**0.021**	**0.021**	**0.018**	**0.014**

= sample exceeds NH Level of Concern

Table 9- Lead (µg / L)

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale
2001	May	<0.10	<0.10	1.88	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	1.88
	June	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	July	<0.10	1.33	1.43	<0.10	1.68	2.58	2.12	2.33	2.57	2.01
	August	<0.10	n/a	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Mean		**n/a**	**1.33**	**1.66**	**n/a**	**1.68**	**2.58**	**2.12**	**2.33**	**2.57**	**1.94**
Max		**n/a**	**1.33**	**1.88**	**0.00**	**1.68**	**2.58**	**2.12**	**2.33**	**2.57**	**2.01**
Min		**n/a**	**1.33**	**1.43**	**0.00**	**1.68**	**2.58**	**2.12**	**2.33**	**2.57**	**1.88**

Table 10- Copper (µg / L)

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale
2001	May	2.51	n/a	2.82	2.5	2.95	2.5	2.5	6.29	4.79	2.5
	June	6.21	n/a	<2.5	<2.5	<2.5	<2.5	<2.5	2.77	<2.5	2.77
	July	<2.5	n/a	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
	August	<2.5	n/a	2.5	2.5	<2.5	<2.5	<2.5	<2.5	4.21	2.91
2002	May	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
	June	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
	August	<2.5	<2.5	<2.5	<2.5	<2.5	5.10	3.20	2.80	<2.5	<2.5
Mean		**4.36**	**n/a**	**2.66**	**2.50**	**2.95**	**3.80**	**2.85**	**3.95**	**4.50**	**2.73**
Max		**6.21**	**n/a**	**2.82**	**2.50**	**2.95**	**5.10**	**3.20**	**6.29**	**4.79**	**2.91**
Min		**2.51**	**n/a**	**2.50**	**2.50**	**2.95**	**2.50**	**2.50**	**2.77**	**4.21**	**2.50**

Table 11- Zinc (µg / L)

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale
2001	May	<9	n/a	<9	<9	<9	<9	<9	<9	<9	<9
	June	10	n/a	<9	9	<9	<9	11	9	12	<9
	July	<9	n/a	<9	<9	<9	<9	<9	<9	<9	<9
	August	<9	n/a	<9	<9	<9	<9	<9	<9	<9	<9
Mean		**10.00**	**n/a**	**n/a**	**9.00**	**n/a**	**n/a**	**11.00**	**9.00**	**12.00**	**n/a**
Max		**10.00**	**n/a**	**n/a**	**9.00**	**n/a**	**n/a**	**11.00**	**9.00**	**12.00**	**n/a**
Min		**10.00**	**n/a**	**n/a**	**9.00**	**n/a**	**n/a**	**11.00**	**9.00**	**12.00**	**n/a**

Table 12- Cadmium (µg / L)

	Site	28 ASH	27 ASH	24 ASH	23 ASH	20A ASH	18 ASH	16 ASH	15 ASH	7 ASH	1 ASH
		Rt 31	Mt Road	Rt 10	Rt 10	Stone Ar	Rt 101	Cresson	Thompson	Rt 119	147 River St
Year	Month	Washington	Lempster	Marlow	Gilsum	Keene	Keene	Swanzey	W. Swanzey	Winchester	Hinsdale
2001	May	<0.25	n/a	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
	June	<0.25	n/a	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
	July	<0.25	n/a	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
	August	<0.25	n/a	<0.25	<0.25	<0.25	0.47	<0.25	<0.25	<0.25	<0.25
Mean		**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**0.47**	**n/a**	**n/a**	**n/a**	**n/a**
Max		**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**0.47**	**n/a**	**n/a**	**n/a**	**n/a**
Min		**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**0.47**	**n/a**	**n/a**	**n/a**	**n/a**

Appendix 7. TNC Land Conservation Plan

Executive Summary

A Land Conservation Plan for the Ashuelot River Watershed

July 2004

The Nature Conservancy
Monadnock Conservancy
Society for the Protection of New Hampshire Forests
Southwest Region Planning Commission

The full document is available from:

The Nature Conservancy:
New Hampshire Field Office
22 Bridge Street, 4th Floor
Concord, New Hampshire 03301
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EXECUTIVE SUMMARY

A Land Conservation Plan for the Ashuelot River Watershed

July 2004

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH

MONADNOCK CONSERVANCY

SWRPC
Southwest Region Planning Commission

SOCIETY FOR THE PROTECTION OF NEW HAMPSHIRE FORESTS
SINCE 1901

A Land Conservation Plan for the Ashuelot River Watershed

July 2004

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GAP status analysis research by Jenny Tollefson

Developed though a partnership of:
The Nature Conservancy
Monadnock Conservancy
Society for the Protection of New Hampshire Forests
Southwest Region Planning Commission

Generous funding support provided by:
New Hampshire Dept. of Environmental Services
Watershed Assistance Program

Acknowledgements

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Thank you to the agencies and organizations that are working to conserve the Ashuelot River watershed, including the Ashuelot River Local Advisory Committee, the Harris Center for Conservation Education, the New Hampshire Fish and Game Department, the New Hampshire Department of Resources and Economic Development, the U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers. Individually and collectively, your efforts are making a huge difference!

Special thanks to the New Hampshire Department of Environmental Services, Watershed Assistance Program, which helped to fund this plan because the State of New Hampshire recognizes the connection between conserving land and maintaining water quality for human and wildlife communities.

We gratefully acknowledge the many citizens and towns engaged in land conservation throughout the watershed. Your knowledge, dedication, and hard work have resulted in an outstanding network of protected lands and waters, and have built the foundation for long-term conservation success.

Executive Summary

Background

The 269,800-acre Ashuelot River watershed in southwest New Hampshire is a diverse and ecologically significant river system. The river and its tributaries flow through 25 New Hampshire and two Massachusetts towns, and provide clean water, wildlife habitat, abundant wetlands, productive forests, and outstanding recreational resources. The Ashuelot River is a major tributary to the Connecticut River basin, and the watershed includes some of the least fragmented forested landscape in southern New Hampshire – and as such provides a significant opportunity for preserving wild places.

This Land Conservation Plan was developed through a partnership of The Nature Conservancy, the Monadnock Conservancy, the Society for the Protection of New Hampshire Forests, and the Southwest Region Planning Commission. It was created with public input from a broad range of stakeholders including citizens, scientists, conservation organizations, and natural resource agencies.

Our vision: the special habitats and river resources representing the unique natural heritage of the Ashuelot River watershed are protected within a landscape of well-managed forests, agricultural lands, and natural areas. People use these interdependent resources in ways that maintain the native plants, animals and natural communities of the region, and the natural processes that sustain them.

Purposes of this Plan

The *primary purposes* of the Ashuelot River Watershed Land Conservation Plan are to provide a blueprint for conservation action, and to develop a greater understanding among land trusts and other entities for how to engage, individually and collectively, in land conservation. Our hope is that the plan will serve as a valuable guide, tool, and information resource for landowners, communities, land trusts, and public agencies that are interested in land conservation.

In addition, plan objectives are to:

- greatly enhance the understanding of the importance, distribution, and status of the watershed's key natural resource features;
- develop a shared vision and a set of clear priorities for land conservation in the Ashuelot River watershed; and,
- galvanize support to effect land conservation.

This plan is unique in that it provides a systematic, science-based, watershed-scale approach for identifying and protecting areas that are most important for plants, wildlife, ecosystems, and water quality in the Ashuelot River watershed. It is not intended to supplant other plans that address natural resource issues in the region, but rather to augment and complement.

Methodology for Developing the Plan

We used a systematic process for conservation planning that was developed by The Nature Conservancy as a conservation planning tool, and which is used by organizations around the globe. We followed four sequential steps:
1) *Identify Conservation Targets* –what is it that we want to conserve in the Ashuelot watershed?
2) *Identify Stresses* – what are the types of degradation and impairment that are affecting Conservation Targets in the Ashuelot?
3) *Identify Sources of Stress* – what land uses, policies, or other agents are causing the Stresses? We refer to these as "threats", and tried to prioritize those likely to have the greatest natural resource impacts in the next 5-10 years.
4) *Develop Strategies* – what types of conservation activities will best help to abate threats and maintain the long-term existence and health of our Conservation Targets? This step included identifying, documenting, and mapping areas that, from a watershed perspective, are especially important for plants, wildlife, ecosystems, and water quality.

In developing the plan, the partners sought input from a variety of people, organizations, and agencies familiar with the Ashuelot watershed. We consulted with local scientists and naturalists, natural resource agency staff, consultants, and others.

Conservation Targets

This plan focuses on seven primary conservation targets, which reflect the principal *natural landscape features* in the Ashuelot watershed. Each of these targets, in turn, represents a much larger set of natural resource and public values that are embedded within, and/or benefit from the protection of, the conservation targets. The targets are:

1) Ashuelot River Mainstem
2) Major Tributaries
3) Small Tributaries and Headwater Streams
4) Unfragmented Forest Ecosystems
5) Forest Patch Communities
6) Important Wetland Communities and Complexes
7) Significant Wildlife Habitats

Threats

We evaluated threats to the persistence and health of conservation targets using four principal criteria: the severity of the threat, geographic extent (e.g., localized, widespread), the contribution of the threat relative to other threats acting on the conservation target, and its irreversibility (i.e., can the damage be undone?). Based on our analysis, we believe the primary stresses to the Ashuelot River watershed include:

- Habitat destruction
- Habitat fragmentation
- Altered forest structure
- Altered hydrologic regime
- Toxins and other contaminants
- Altered species composition
- Nutrient loading
- Sedimentation
- Thermal alteration

The primary sources, or causes, include:

- Incompatible residential development
- Development and upgrade of roads and utilities
- Poor logging practices
- Presence and operation of dams
- Invasive species (e.g., purple loosestrife, milfoil) and forest pests and pathogens (e.g., hemlock woolly adelgid)
- Inadequate stormwater management
- Atmospheric deposition (e.g., acid rain, mercury)
- Incompatible recreation (e.g., ATVs in sensitive areas)

Important Areas for Plants, Wildlife, and Ecosystems

Through a complex set of science-based analyses, we identified thirteen terrestrial areas and twenty river and stream reaches that are considered to be of exceptional habitat significance from a watershed perspective (see attached map). These areas are listed below, and their natural resource features and public values are described in detail in the body of the plan:

Important Terrestrial Areas

- Ashuelot Headwaters
- Otter Brook & Andorra Forest
- Dart Brook Watershed
- Grassy Brook Watershed
- Surry Mountain
- Roaring Brook & Keene Water Supply
- Monadnock
- California/Wheeler Brook Watersheds
- Ash Swamp Brook
- Pisgah
- South Branch Confluence
- Sprague Brook Watershed
- Ashuelot River Mouth

Important River and Stream Reaches

- Ashuelot River (lower & upper)
- South Branch
- Minnewawa Brook
- Tufts Brook
- Broad Brook
- Kilburn Brook
- Hog Tongue Brook
- Wheeler Brook
- Rice Brook
- Fall Brook
- Shaker Brook
- Roaring Brook
- Sprague Brook
- Beaver Brook
- Hurricane Brook
- White Brook
- Dart Brook
- Thompson Brook
- Grassy Brook
- Spaulding Brook

Status of Land Conservation in the Ashuelot River Watershed

Thanks to the foresight and dedicated efforts of many communities, citizens, conservation organizations, and public agencies, the Ashuelot has a significant base of public and private conservation lands. Yet our analysis also highlights areas of significant need, where current status falls far short of accomplishing important conservation goals for the watershed. Major findings are as follows:

- **23% of the watershed (~63,700 acres) is considered as "conservation land."** Conversely, more than three-quarters of the watershed has no conservation status (i.e., no legal protection or conservation mandate).

- 21% of the watershed is *permanently* protected from conversion. An additional 2.8% is currently being managed by public or institutional owners to retain natural land cover, however these lands have no permanent legal protection and are thus vulnerable to land use conversion.
- **Only 3.5% of the watershed is protected and managed as natural area or ecological reserve**. These lands are managed primarily for their natural habitats and ecological processes, and timber harvesting and other extractive uses are not permitted. The vast majority (5/6th) of conservation lands are protected and managed for multiple natural resource purposes that include activities such as timber harvesting.
- The land conservation status of important habitat areas identified in this plan varies considerably, ranging from 0% conserved to more than 65% protected. **In nine of the thirteen important habitat areas, less than 25% of the land is protected.**
- **Lower elevation lands,** which include river valleys and riparian areas, highly productive forest and agricultural soils, and an abundance of important fish and wildlife habitat, **are notably under-represented in conservation status.**

Conservation Strategies

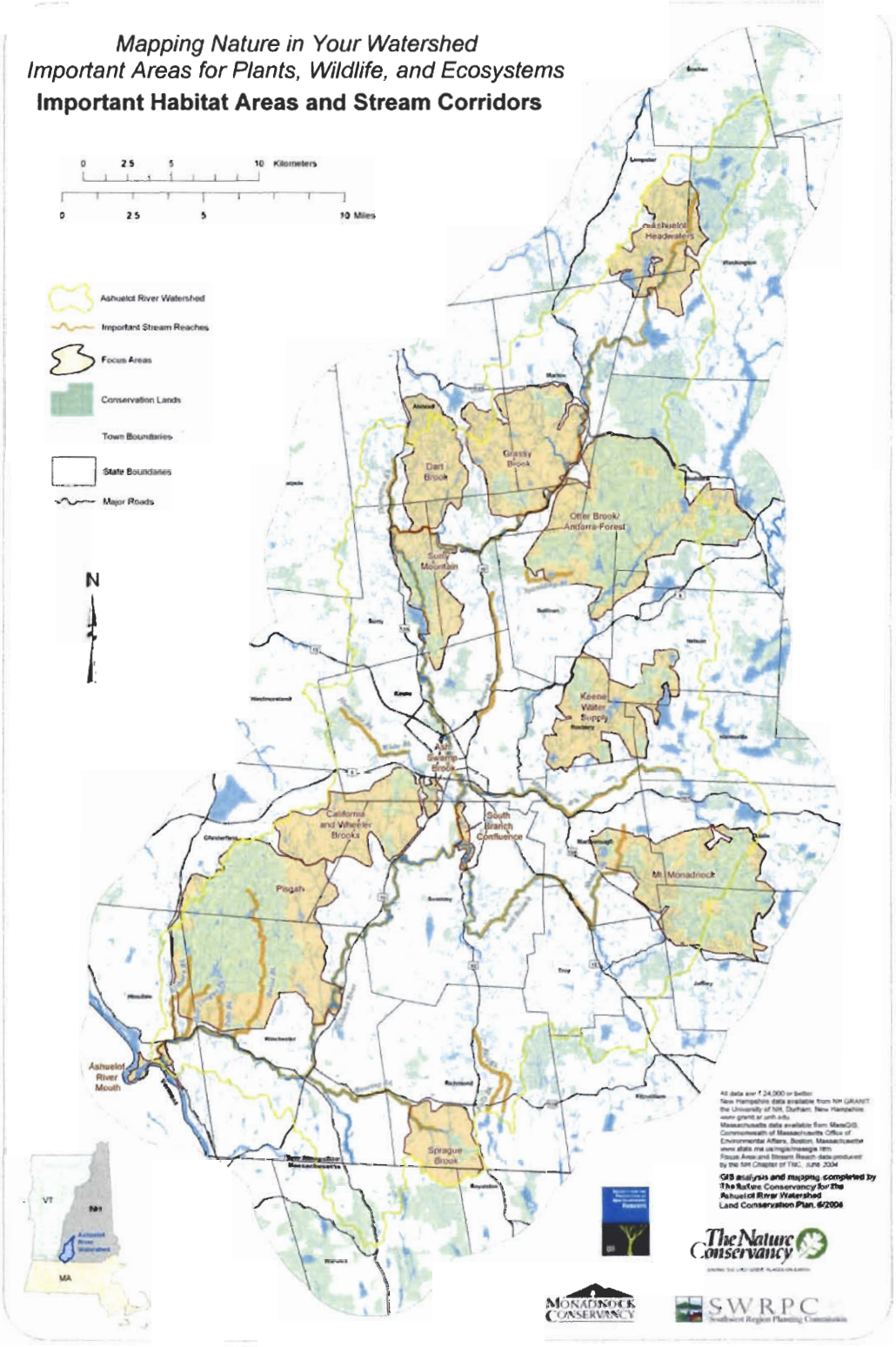
Conservation strategies represent actions necessary to maintain current high quality natural features, and to reduce the stresses that are degrading and impairing, and thus lowering the viability, of the conservation targets. Although there are many different kinds of conservation strategies (e.g., land protection, public policy, stewardship), for the purposes of this plan we highlight strategies designed to advance land and water conservation.

The following nine strategies are described in further detail in the body of the plan.

1. Launch an Ashuelot River watershed land protection partnership.
2. Encourage conservation easement and fee simple donations through targeted landowner outreach and education.
3. When necessary and appropriate, purchase conservation easements or fee simple interests.
4. Use land protection to maintain large, un-roaded forest blocks and to protect un-dammed stream reaches and networks.
5. Protect and manage conservation properties in a manner that achieves a sound balance of natural areas and working lands.
6. Maintain or restore important landscape connections and corridors that result in a functional network of habitat conservation areas for wildlife movement, and which prevent long-term fragmentation into disjunct conservation "islands."
7. Protect riparian areas to help preserve water quality, fisheries, and wildlife habitat.
8. Build community awareness of the natural resources, conservation status, and principal threats in the watershed, and promote community support for implementing this plan.
9. Increase private and public funding support for land conservation.

Conserving this remarkable landscape for current and future generations will only be achieved through a coordinated, sustained effort that builds on the history of voluntary

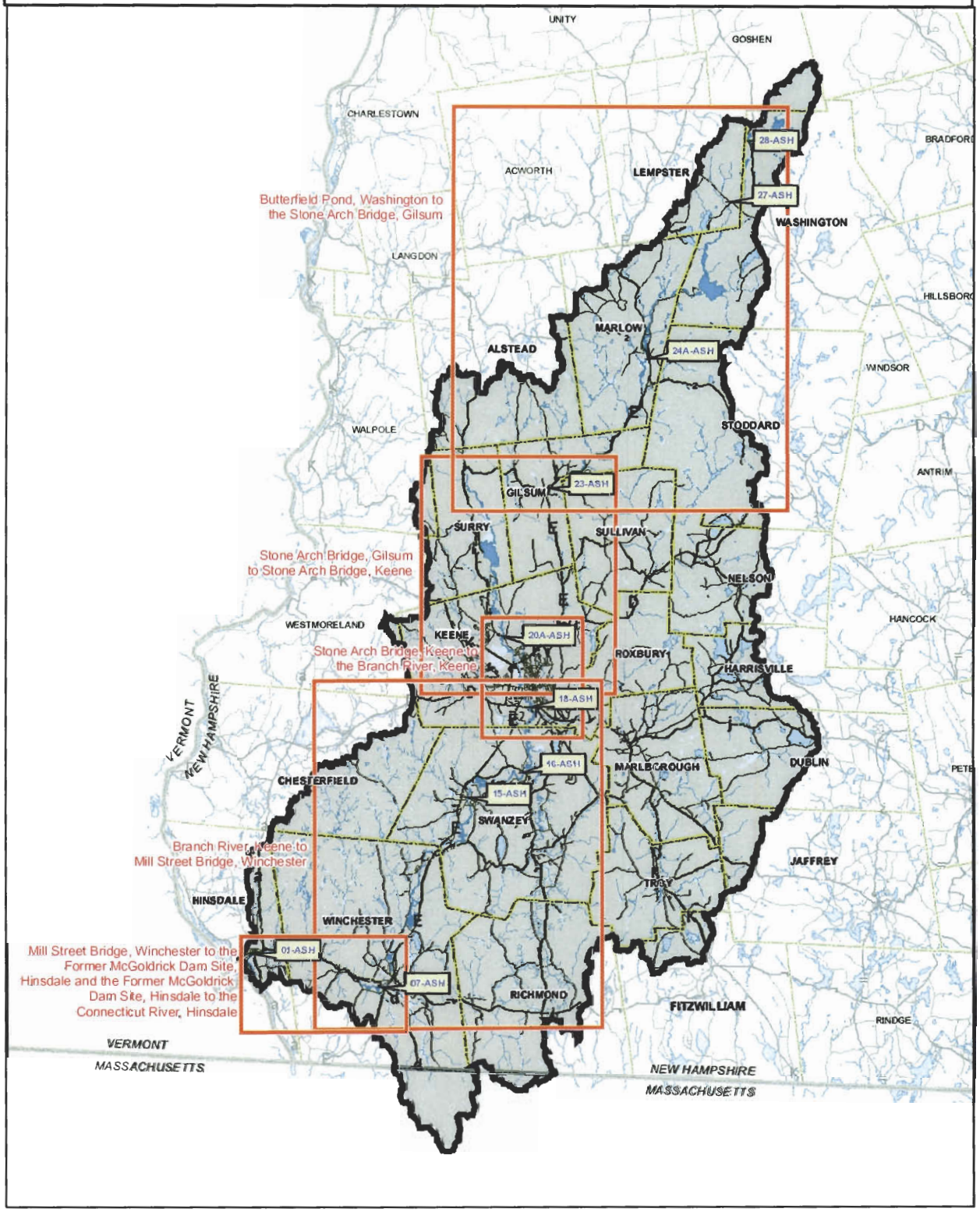
land conservation in the Monadnock region and includes cooperation from private landowners, towns, public agencies, land trusts, and others.



Important Habitat Areas and Stream Corridors

Ashuelot River Corridor Management Plan, 2006 Update

Overview Map



SWRPC

Not intended for site specific work

Ashuelot River
Town Boundaries
State Roads
Local Roads

Water Quality Monitoring Site
Map Areas
Ashuelot River Watershed
Stream or River
Lake or Pond

0 3 6
Miles

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