Town of Madbury, New Hampshire

Master Plan: Toward the Year 2010

2.2 Water Resources

Prepared for

Town of Madbury Planning Board
Madbury, New Hampshire

by

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Water Resources

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Water Resources

1. Policy Statement

Vigorously protect water resources in Madbury from contamination, depletion, and visual disfigurement. Act as stewards for municipal and regional water supplies located within the Oyster River, Bellamy River, and Little Bay watersheds.

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

In general there is a direct relationship between land use and water quality. It is the responsibility of the Town to take reasonable and prudent precautions to protect all water resources from incompatible uses, thus protecting the health and general welfare of the community.

Madbury provides a substantial volume of water to other municipalities in the region. Appropriate steps should be taken by the Town to insure that sufficient water supplies exist for use by Madbury residents, as well as native wildlife and plant communities. The Town needs to examine and address water supply issues, watershed management, pollution, and potential aquifers/gravel areas.

Guidance for policies, regulations, and actions that affect Madbury's water resources derives from the following water resources management objectives.

a. *Protect public health, safety, and welfare*
b. *Maintain high environmental quality*
c. *Ensure that growth does not compromise (degrade) environmental quality*
d. *Direct development to environmentally suitable areas*
e. *Assure adequate water supply for residents*
f. *Preserve water quality and quantity for future residents*
g. *Educate residents about water resource issues*
h. *Participate in inter-municipal water resources management efforts*
i. *Comply with applicable local, state, and federal regulations*

2. Description of Surface Water Resources

2.1. **Watersheds.** Madbury's surface water flows through three watersheds: the Bellamy River Watershed in the northwestern portion of town, the Oyster River Watershed in the southeastern portion of town, and the Little Bay Watershed of the Great Bay Estuary. All three watersheds drain into the Piscataqua River Basin that includes the Lamprey, Swampscott, and Cocheco watersheds. Two-thirds of the 930 square mile Piscataqua Basin lies within New Hampshire and the remainder in southern Maine. Table 1.1 (Appendix 1) summarizes the watershed characteristics of the Bellamy River, Oyster River, and Little Bay. The Bellamy River Watershed comprises over 57% (4,512 acres) of Madbury's land area, while the Oyster River watershed comprises about 42% (3,287 acres). The surface water runoff boundary between the Oyster and Bellamy Rivers generally flows west to east across Madbury. Similarly, 1998 stratified drift aquifer maps indicate that most of Madbury's stratified drift aquifer follows the watershed boundary, with virtually all of the aquifer occurring within the Bellamy River Watershed. [1] A fraction of a percent of Madbury's land falls within the coastal Little Bay Watershed.

2.2. **Rivers.** The Bellamy River originates at Swains' Lake (also known as Union Lake) in Barrington and flows in a southeasterly direction toward the Bellamy Reservoir in Madbury. Below the reservoir dam the Bellamy continues flowing to the southeast through Dover until being impounded again at the Sawyer Mills. Below the Sawyer Mills dam the river becomes tidal and empties into Little Bay at the Scammel Bridge.

The Oyster River originates near Creek Pond in Barrington and flows in a southeasterly direction toward Durham, at which point it flows to the east. The river is tidal below the Mill Pond dam in Durham, and from there flows southeast into Little Bay. Three minor drainages of the Oyster River flow out of Madbury: in the south central portion of town at Beard's Creek, in the eastern portion of town as the Gerrish/Johnson Creek drainage, and in the southwestern portion of town east of Dube Hill. The Gerrish/Johnson Creek drainage flows directly into tidal waters separately from the rest of the Oyster River Watershed.

2.3. **Lakes and Ponds.** Table 1.2 (Appendix 1) summarizes Madbury's surface water bodies. The Bellamy Reservoir is the largest standing body of water in Madbury. It was created in the early 1960's to serve as the primary water supply for Portsmouth in exchange for the federal government's taking of Portsmouth's previous water supplies for Pease Air Force Base. Water from the Bellamy Reservoir currently provides water to seven communities in the Seacoast region including Madbury, Newington, Rye, New Castle, Greenland, and Durham in addition to Portsmouth. The majority of Barbadoes Pond is located in Madbury. It is approximately 16 acres, and is 48 feet at its deepest point. Its median depth is 20 feet, and its shoreline is about 3,280 feet. NH DES rates Barbadoes Pond as mesotrophic, meaning that it contains moderate nutrient levels that result in moderate algal growth. Hoyt Pond flows into Gerrish/Johnson Creek. Table 1.3 (Appendix 1) summarizes the characteristics of Barbadoes Pond, the Bellamy River, and Hoyt Pond.

Several smaller bodies of water are used for fire fighting, recreation, and aquatic habitat. Additional information on smaller ponds and water bodies is available through the Madbury Conservation Commission.

Recommendation: In order to ensure that these resources are protected for future uses, the town should create a report documenting and mapping smaller water bodies and their uses.

2.4. **Dams.** There are currently 23 state-registered dam sites in Madbury. A list of state dam permits is provided in Appendix 3. The Bellamy Reservoir dam, approximately 200 meters to the west of Mill Hill Road, is the largest dam in town. The dam is 38.5 feet tall, and creates a water body of approximately 324 acres. Dams are permitted and inspected by the New Hampshire Water Resources Board. The Board is responsible for regulating all structures in waterways that are four or more feet high. Dams are currently used for two purposes in Madbury. Primarily, dams are used to impound surface water. Secondarily, dams serve as a means of controlling floodwaters and alleviating the destruction that floods can cause. Madbury's impounded surface water is an important resource that provides a water supply source, aquatic habitat, and a variety of recreational opportunities to the Seacoast Region. There are no hydroelectric sites in Madbury.

2.5. **Wetlands.** Wetlands are a significant part of Madbury's water resources. Table 1.4 (Appendix 1) summarizes Madbury's wetland areas by size. Wetlands are defined by three characteristics: hydrology, hydric soils, and wetlands vegetation. Hydrology, the presence of water, is one characteristic. If water is present on the surface or in soils for a sufficient period of time, the soil is classified as hydric soil. The third defining characteristic is wetlands vegetation. [2] Soil in wetlands lacks oxygen, affecting the ability of vegetation to survive. Wetlands vegetation is adapted to saturated soil conditions with low oxygen and have a competitive advantage there. If greater than 50% of the plant life in a given area is wetlands vegetation then that area is considered to be wetland. Some wetland plants are considered indicator species since their presence serves as an immediate indication that the area is a wetland. An example of an indicator species is the cattail, which may be prevalent in saturated soils but will not grow in an upland soil. [3] Wetlands vegetation traps sediments, and their root systems help to ensure the stability of the underlying soil, thereby preventing erosion. Wetland plants also have some ability to remove pollutants such as organic material, bacteria, and excess nutrients like nitrates and phosphates, improving water quality.

2.5.1. **Location and acreage of wetlands.** The Town of Madbury's wetlands were delineated using soil type data from 1973. In Madbury 2,285 acres of soil are classified as hydric, comprising approximately 30% percent of the town's land area. [4] The northwestern corner of Madbury, due north of Route 9 and bordering the Bellamy Reservoir, has a high concentration of hydric soils. [5]

Strafford County is overdue for an updated soil survey from the Natural Resources Conservation Service. The 1973 survey is the most current comprehensive soil survey available to the town. This information is available on the NH GRANIT geographic information system database.

Recommendation: Protection of water resources through the use of a wetlands conservation overlay zone applied to salt marshes, wetlands, and surface waters (ponds, first order streams, headwaters) is a priority of the Town to be enforced by the Planning Board.

2.6. **Floodplains.** Floods are naturally occurring events on most surface waters. Floodplains are areas adjacent to rivers, streams, and surface water bodies that are susceptible to flooding during periods of excessive runoff. On any given stream or river, the flow that is equaled or exceeded, on the average, once in 100-years is called the 100-year flood, and any land area, outside of the channel banks, that is covered during the l00 year flood is the floodplain. Floodplains store water in times of flooding and limit damage in adjacent areas. Floodplains are an integral part of the riparian structure of many surface waters. The extent, condition and use of floodplains may have a significant effect on flood stages of downstream and upstream locations. Madbury has an estimated 1,100 acres within the 100-year floodplain along the Bellamy River. [6]

If developed areas lie in the floodplain, property and safety are threatened. Restricting development in the floodplain is the preferred method of minimizing flood damage. Currently Madbury does not allow new development within floodplains. This policy, combined with wetland preservation, should minimize flooding risks in Madbury.

Recommendation: Continue prohibition of construction within the 100-year floodplain.

2.7. **Salt Marshes.** Salt marsh habitat protection is critical to the protection of the Great Bay Estuary ecosystem. The biological productivity of the oceans is primarily a function of its estuarine ecosystems. These areas provide critical habitat for several commercially valuable fisheries. Madbury's salt marshes are an important component of regional, state and national resources. [7]

Recommendation: Use best management practices, careful monitoring of activities, and restoration for land uses within the Little Bay watershed to prevent pollutants from entering the Great Bay estuary.

2.8. **Surface Water Uses**. The owners and operators of Madbury's public drinking water supplies as identified by NH DES are listed in Appendix 2.

2.8.1. **Local Consumptive Uses**

2.8.1.1.**Fire Protection.** The use of water for fire protection is a consumptive use. A well at the fire station provides water to fill tanks in the fire trucks, and fire hydrants are used to supplement supplies at various points in town. When more water is needed and no hydrants are nearby, water may need to be pumped directly from surface waters using a hose. Emergency water uses, such as for fire fighting, are necessary for the protection of public health.

2.8.2. **Regional consumptive uses.** Table 1.6 (Appendix 1) summarizes regional use of Madbury's water resources.

2.8.2.1.**Portsmouth Water Department:** The Portsmouth Water Department (PWD) has drawn water from the Bellamy Reservoir since the early l960s when the federal government took over Portsmouth's previous supply at the site of Pease Air Force Base. Water withdrawn from the Bellamy Reservoir by the PWD services the communities of Portsmouth, New Castle, Newington, Rye, Greenland, Durham, and Madbury. A filter plant rated at 3.5 million gallons

per day treats water from the reservoir in Madbury then pumps it to Portsmouth. [8] With the closing of Pease Air Force Base in the early 1990's, the federal government returned its Pease water supplies to Portsmouth. Legal research would clarify whether this affects Portsmouth's ownership rights on the Bellamy Reservoir. At the start of 2001, the Portsmouth Public Works Department reported that the water treatment plant on Freshet Road receives an average of 2.25 million gallons per day (MGD) from the reservoir. This leaves an average of 1.5 to 2.0 MGD for downstream flows. State regulations only state: "Unless the flows are caused by naturally occurring conditions, surface water quantity shall be maintained at levels adequate to protect existing and designated uses." [9] There are no quantified minimum flow amounts that govern water withdrawal rates along the Bellamy River.

2.8.2.2.**Dover Water Department:** The Dover Water Department has approval from NH DES to withdraw an average of 720,000 gallons per day from the Bellamy River in Dover and uses this water to recharge the Griffin and Ireland wells on the Pudding Hill Aquifer. Because of seasonal conditions, the Bellamy withdrawal rates fluctuate seasonally. The maximum withdrawal rate of approximately 2.2 million gallons per day occurs during periods of high snowmelt runoff in the spring. [10] [11]

2.8.2.3.**Durham/UNH Water Use:** The University of New Hampshire and Durham draw water from the Oyster River in Durham. Further research into Durham's historical and projected future use of the Oyster River is needed.

2.8.3. **Functioning ecosystems.** Madbury's aquatic ecosystems provide essential services and contribute to the maintenance of regional biodiversity. Ecosystem functions are defined as the capacity of natural processes and systems to provide goods and services that accommodate human needs. These are generally grouped into four functions: regulation, habitat, production and information. Aquatic ecosystems are important *regulators* of water quantity and water quality: floodplains store water when rivers over-top their banks, reducing flood risk downstream and wetlands are natural filtering systems which remove toxins and excessive nutrients from water. Aquatic ecosystems provide critical *habitat* for a wide variety of species. Sustaining the functions of ecosystems requires the maintenance of many biological processes that are the result of complex interactions between soil, water and a multitude of plants, animals and microorganisms. Aquatic ecosystems provide *resources* such as drinking water, fish and game as well as opportunities for recreation, aesthetic experience and reflection. Recreational uses include fishing, hunting, birdwatching, photography, and boating. Maintaining wetlands and capitalizing on these uses can be a valuable alternative to more disruptive uses and degradation of aquatic ecosystems. Protection of aquatic ecosystems is a priority of the Town.

2.9.**Water Quality.** Knowledge of the quality of water resources varies significantly throughout town. The Town currently has little data regarding water quality in major bodies of water such as the Bellamy Reservoir and Bellamy River. Maintaining high water quality is a vital component of protecting aquatic ecosystems and regional drinking water supplies.

Results from well surveys conducted in 1989 and 1990 were compared with state drinking water standards for public water supplies. Of the 63 wells surveyed, 30% passed both the primary and secondary drinking water standards set by the Environmental Protection Agency (EPA). 43%

passed primary standards, and 62% passed secondary standards. The leading reason for failing to meet standards was high fecal coliform levels. [12]

Recommendation for further research: Pursue follow up testing of wells to determine the current state of Madbury's groundwater resources.

3. Groundwater Resources

3.1. **Stratified Drift Aquifers.** Stratified drift formations consist of well-sorted sand and gravel deposits that are typically laid out in layers by historic glacial outwash streams and rivers. Depending on the depth and the coarseness of the material, these deposits generally provide good sources of groundwater because of their capacity to store groundwater and transmit over large areas. The largest withdrawals of groundwater in Madbury are from surficial deposit aquifers. The Pudding Hill, Barbadoes Pond, and Johnson Creek aquifers are proven sources of water. Portsmouth and Dover extract large amounts of water from each of these. The cities of Dover and Portsmouth have municipal wells in drift deposits that occur wholly or partially in Madbury. Specifically, they draw water from the aquifers at Pudding Hill, Barbadoes Pond, and Johnson Creek. The approximate boundaries of area aquifers are best represented on the 1992 map "Stratified-Drift Boundaries, Data Collection Location, and Altitude of the Water Table in the Bellamy, Cocheco, and Salmon Falls River Basins." [13] Madbury has 5.5 square miles of stratified-drift aquifers, representing 46% of the Town's area. [14] Table 1.5 (Appendix 1) summarizes characteristics of known aquifers in Madbury.

3.2.**Bedrock Wells.** Bedrock formations are composed of fractured rock or ledge, with groundwater stored in the fractures. Generally, bedrock wells have a lower yield than stratified drift aquifers. This is primarily because stratified drift has higher transmissivity rates than the New Hampshire bedrock. [15]

3.2.1. **Radon.** Radon is an odorless, colorless, tasteless gas produced through the decay of naturally occurring radioactive minerals in soils and bedrock. Radon gas can dissolve in ground water and later be released into the air during normal household activities such as showering. Exposure to elevated levels of radon increases the risk of developing lung cancer. Typically, radon enters dwellings through soil, but it can also enter buildings via water supplied from wells. According to the State Radon Potential Map, much of Madbury lies in an area of relatively low risk of radon exposure.

A 1994 report found that radon concentrations within the town were highly variable, and that deeper bedrock wells had lower radon concentrations. In general, groundwater in the western third of Madbury has higher radon concentrations than that in the eastern two-thirds of town. All but one of the wells in Madbury contained radon concentrations at levels well below levels of concern. Overall, the study concludes that there is little need for concern with regard to radon concentrations in private wells within Madbury. [16]

3.2 Groundwater Use

3.2.2. **Local use.**

Most households and businesses in Madbury rely on groundwater as their primary source of water, and the majority of groundwater users have wells that draw from bedrock. The Bunker Lane Mobile Home Park and one private dwelling receive water from the Portsmouth Water Treatment Facility. In 1990 the US Census estimated a total of 528 residential dwellings in Madbury. According to building permit data collected between 1991-2000, about 95 houses were built since 1990, bringing the total number of homes in town to 623 in 2000. Since there are approximately 60 manufactured homes in the Park, a fair estimate of the number of privately owned wells in town is 560.

DES has kept data on new wells since 1984. The following is a breakdown of well construction in Madbury as of 2000: [17]

Drilled in Bedrock = 159
Drilled in Gravel = 8
Dug = 0
Driven Point = 0
Wash Well = 0
Undifferentiated = 3 Total wells added between 1984-2000 = 170

The Town of Madbury currently operates four wells that are classified by NH DES as public/community water supplies: one at Town Hall, one on the west side of Route 155, one at the fire station, and the last at the Moharimet Elementary School. The town well on the west side of Route 155 pumps up to a reservoir on top of Hicks Hill. Little information on this town system is available.

3.2.3. **Regional groundwater use.**

3.2.3.1. **Portsmouth** has four wells in the Johnson Creek aquifer and withdraws roughly 0.75 MGD from them.

3.2.3.2. **Dover** draws water from the Barbadoes Pond Aquifer. Dover has two wells in Pudding Hill aquifer and withdraws roughly 1.7 MGD. Further research into Dover's historical and projected future use of the Barbadoes and Pudding Hill aquifers is needed.

4. Potential Surface Water and Groundwater Supplies

There are two locations considered to have potential as aquifers in Madbury. The first is related to the Freshet Creek Aquifer. The second occurs along the northwest border of town. An expansive area, primarily in Barrington, may have low potential to yield significant quantities of groundwater. This could be a significant aquifer, possibly connected to the Hoppers. Well

report data from Barrington indicates that the depth to bedrock at the Barrington/Madbury border along NH Route 9 is over 100 feet. Depth to bedrock is less than 10 feet along Route 9 near the Bellamy Reservoir, and the bulk of the formation is in Barrington. One area of limited potential is also identified, and this is on the north side of Hicks Hill. There is a minor drift deposit, but its small area limits its aquifer potential. [18]

There may be a significant fault at the border between the Eliot and Berwick formations. The presence of a fault does not necessarily indicate a large water-bearing zone. However, this fault may provide open fractures and spaces capable of storing groundwater. [19]

Overall, Madbury's ground and surface water supplies offer limited potential as future water sources for the town. Madbury's overburden aquifers are currently operating at maximum sustained yield, as are most stratified drift aquifers in the Seacoast Area. [20] Bedrock wells are the most common source of water in Madbury and probably will continue to supply water for current and an unknown number of additional future wells. However, bedrock wells are vulnerable to over use and will not offer an infinite supply of water. Bedrock wells have not yet reached a point of maximum yield, but once they do this may eventually restrict development in Madbury.

Until the Town has additional information on the status and potential of its groundwater resources, management of groundwater resources depends upon appropriate development. The Town can help to ensure plentiful and safe groundwater supplies for its future by protecting groundwater supplies through aquifer recharge protection ordinances and by advocating and participating in conservation of water resources.

Recommendation for further research: Studies are needed which conclusively confirm or deny the existence of potential aquifers, to identify sustainable yield rates from known aquifers, to examine the potential for artificial recharge of groundwater, and to establish a system of monitoring groundwater resources.

5. Potential Threats to Water Resources

Madbury's water resources are threatened by point-source pollution, non-point source pollution, and unsustainable use. As residential and commercial growth continues throughout the Seacoast region, dependence on the area's limited water resources increases. Over the next decade, water resource use will become a predominant planning concern of many Seacoast municipalities. Many area communities are operating near or at their current supply of water, and as growth continues pressure builds to utilize all available water. Between 1999 and 2002, The City of Portsmouth is developing a 20-year Water System Master Plan that will review supply and demand of the seven communities that rely on the City's water. The US Geologic Survey is interested in examining Seacoast region groundwater and determining the current and future status of water availability and sustainable yield. Currently, Madbury's groundwater is vulnerable to contamination from several non-point sources of pollution described below.

Recommendation: Establish an aquifer protection overlay district or similar zoning tool to protect groundwater resources.

The NH DES groundwater hazard inventory for Madbury is listed in Appendix 4.

5.1. **Point Source Pollution.** New Hampshire Code defines a point pollutant source as, "…any discernible, confined or discrete conveyance from which pollutants are or may be discharged, including but not limited to, pipes, ditches, channels, conduits, wells, containers, rolling stock, concentrated animal feeding operations or vessels." [21] Point sources of pollution are identifiable discharges of pollutants into the environment at a specific point, such as a factory discharging chemicals out the end of a pipe. Historically, Madbury's has faced few threats to water supplies from point sources of pollution. The Town should continue to prevent point-source pollution from contaminating water resources.

5.2. **Non-point Source Pollution.** New Hampshire Code defines a non-point pollutant source as: "A source of pollutants which is diffuse in nature and discharges pollutants over an area into the environment." [22] Because of Madbury's current lack of significant industrial and commercial development, non-point pollution is the predominant threat to the town's water resources.

Recommendation for further research: Develop a system whereby the Town can effectively monitor non-point pollution over time.

5.2.1. **Underground storage tanks.** Underground storage tanks may leak and go undetected, resulting in contamination of groundwater. Appendix 5 provides a list of Madbury's past and present underground storage tanks. As of October 2000, there is one underground storage tank registered in Madbury with NH DES. This 8,000-gallon composite tank was installed in October of 1998 by the City of Portsmouth to store hazardous substances at the city's Water Treatment Plant.

Underground storage tanks are regulated under the *Control of Nonresidential Underground Storage and Handling of Oil and Petroleum Liquids* regulations. These rules affect any existing facility with one or more tanks greater than 1,100 gallons, and all new or substantially modified facilities with a combined site capacity of greater than 1,100 gallons. Currently there are no tanks of this kind in Madbury. [23]

5.2.2. **Sand and gravel excavation.** Sand or gravel pit sites are frequently located in thick drift deposits that are prime aquifer recharge areas. In order to protect groundwater resources, excavations should stay above the water table and efforts should be taken to ensure that fuel, oil, or other liquids do not leak or spill into the ground. The risk of contamination increases as the depth of excavation nears the water table because there is less overlying material to filter out contaminants.

Pike Industries has a permit to use hydro-mining techniques to remove gravel at a site next to Barbadoes Pond. The project includes below water table mining, meaning that groundwater is extremely vulnerable to contamination. Pike Industries also operates an asphalt paving (hot top) facility at the site. The project could contaminate groundwater. [24] At the site, soil is stripped off, removing an important filter for groundwater. The excavation site is above a known aquifer, and

regular monitoring is needed to ensure that groundwater is not contaminated. In November 1988, this project was estimated to disturb 65 acres of land adjacent to Barbadoes Pond. [25] When finished, the disturbed area will be approximately 100 acres, with a 50-acre, 40-foot deep pond leftover.

Recommendation: Modify ordinances to leave 4-8 feet of sand and/or gravel above the estimated seasonal high water table at gravel operations.

5.2.3. **Scrap-Metal Recycling.** Another non-point pollution threat is the New England Metals operation, which is situated in an excavation site above the Pudding Hill Aquifer. Madbury Metals is a scrap metal processor, converting metal wastes into marketable scrap metal. Incidental wastes that are accepted with the metal wastes such as motor oil, brake fluid, and car upholstery could contaminate the Pudding Hill Aquifer. Currently, the NH DES oversees the operation of this facility. However, the town has more of a vested interest in the site and should more actively monitor its environmental impacts.

Recommendation: Madbury should amend its zoning ordinance to control the use of excavation sites. Various types of controls are available, and could be implemented during the excavation permit application process under RSA 155-E.

Recommendation: Protect the Pudding Hill aquifer through the use of best management practices and monitoring of activities for existing development located within the Commercial and Light Industry zone.

5.2.4. **Road salt**. The salting of roads in winter is a non-point source of pollution. Best management practices for minimizing pollution include covering salt piles, loading salt trucks on paved areas, and the use of modern salt application equipment. [26] Excessive use of road salt can unnecessarily contaminate water. Careful judgment when applying road salt minimizes water contamination. Salt contaminated wells have been found in Madbury along Route 9, but the source of this contamination is unknown.

Recommendation for further research: Study the impacts of road salting on Madbury's ground and surface water supplies.

5.2.5. **Dover Municipal Landfill**. At this time the primary external threat to Madbury's water resources is the Dover Municipal Landfill on Tolend Road in Dover, an Environmental Protection Agency (EPA) Superfund site. The landfill was opened in 1954 and closed in 1980 and is split north/south between the Cocheco River Watershed and the Bellamy River Watershed, respectively. The EPA has monitored two contamination plumes from the site since the 1980's with test wells around the site's perimeter. There is evidence that the eastern contamination plume has already reached the Cocheco River. The EPA's Remedial Investigation of the landfill, released in December l988, indicated that another contamination plume might be headed toward the Bellamy Reservoir. Models from the investigation projected that the southern contamination plume from the landfill would reach the Bellamy Reservoir between 2000 and 2010, a process that could be accelerated if withdrawal levels from the Bellamy Reservoir increase. Increasing

the withdrawal rates from the Bellamy Reservoir may be an option Portsmouth is considering in its 20 year Water System Master Plan.

The Bellamy Reservoir is Madbury's most important water resource. The Town should be regularly updated regarding the spread of the Dover Landfill contamination plumes. One inexpensive and convenient way to do so would be for the Water Board to obtain copies of laboratory analyses performed in and around the Tolend Road site. Or, if possible, the town could be added to the laboratory's receivers list in order to directly acquire the data. It is important for the town to be updated regarding water quality in the Bellamy Reservoir as well.

Recommendation: Devise a system whereby the Town receives regular updates on the status of Tolend Landfill contamination plumes and their effects on the water quality of the Bellamy Reservoir and nearby groundwater.

5.2.6. **MtBE.** MtBE is the abbreviation for the compound methyl tertiary butyl ether. MtBE is a manmade material and its presence in water indicates that contamination exists in the recharge area of a well. MtBE is a gasoline additive originally meant to replace lead as an octane enhancer and currently used to reduce ozone and carbon monoxide emissions from automobiles. MtBE, a volatile organic compound (VOC) is classified by the EPA as a possible human carcinogen, and occurs in groundwater as a result of contact with gasoline. As of May 2001, the State Legislature is considering banning the use of MtBE as a gasoline additive statewide. In the meantime, minimizing threats of MtBE contamination in groundwater depends on eliminating gasoline spills and leaks through proper storage, handling, and disposal of gasoline. A 2000 report on VOCs in Madbury was based on a survey of seventy-four wells in Madbury. Sixty-seven of the seventy-four wells surveyed (90.5%) had no detectable VOCs. However, seven wells were contaminated with low concentrations of VOCs: six with MtBE and one with tetrachloroethene (PCE). The report recommends taking action to reduce exposure to MtBE at two locations: at the Mill Hill Trailer Park and at one private well on Pudding Hill. In addition, the report recommends that all seven wells should be monitored on a quarterly basis for two years to determine long-term VOC concentrations. [27]

5.2.7. **Septic Systems.** A conventional septic system consists of a settling or septic tank and a soil absorption field. A typical system accepts both greywater (wastewater from showers, sinks, and laundry) and blackwater (wastewater from toilets). Septic failure is defined as "the condition produced when a subsurface sewage or waste disposal system does not properly contain or treat sewage or causes or threatens to cause the discharge of sewage on the ground surface or into adjacent surface or groundwater." [28] The most common type of failure of these systems is from clogging of the absorption field, insufficient separation distance to the water table, insufficient percolation capacity of the soil, and overloading of water. Septic failure can result in nutrients such as phosphorus draining into ground and surface water. In surface water, excess phosphorus levels can result in rapid plant and algal growth, decreasing dissolved oxygen levels and fish populations. Septic systems in new developments need to meet state regulations. Close adherence to zoning ordinances, subdivision regulations, percolation test and pit test requirements is the most effective way to minimize septic-related water pollution.

5.2.8. **Erosion & Sedimentation.** Erosion is a process by which soil is carried by water or wind. When water carries soil into a waterbody, it not only contributes to filling in the waterbody but also contributes nutrients that cause algal blooms and aquatic weeds to grow. Erosion at construction sites is a leading cause of water quality problems due to removal or disturbance of vegetative cover. Limiting and phasing vegetation removal during construction can reduce soil erosion. Sedimentation occurs when water carrying eroded soil particles slows long enough to allow soil particles to settle out. The smaller the particle, the longer it stays in suspension. Erosion control should be encouraged in order to protect the quality of Madbury's public waters.

The New Hampshire Comprehensive Shoreland Protection Act (CSPA) was passed to protect New Hampshire's lakes, ponds, rivers, and estuaries. The CSPA requires that any excavation or earth moving in protected shoreland must have appropriate erosion and sedimentation controls. [29]

5.3 Instream flow. The State is developing an instream flow rules process for State-designated protected rivers. This process is still in the early stages of development but will eventually require that rivers reach-specific assessment of designated uses (fish, boating, waste assimilation, etc.) and their flow needs. Water use will then be managed through conservation, impoundment management and water use restrictions or alternative supplies to maintain that flow need. Because the Bellamy River does not have State-designated protected status, the proposed Instream Flow Rules will not immediately apply. However, the process may be applied statewide eventually.

DES recently issued a 401 certification (water quality) for Durham's withdrawal from the Lamprey River. The certification limits downstream flow depending on the amount of water flowing in the river. This method is likely to be the State practice for issuing 401 certifications in the near future. Calculations that represent current flow rates are used to identify withdrawal restrictions and cessation. There are no known flow restrictions for the Bellamy Reservoir or the river at this time. The lack of a permit or certificate leaves the qualitative standards in DES' Water Quality Standards as the primary rule affecting flow. State regulations only require that "Unless the flows are caused by naturally occurring conditions, surface water quantity shall be maintained at levels adequate to protect existing and designated uses." [30]

5.4 Regional Water Concerns. If water consumption rates parallel the rapid population and housing growth of recent years, the Seacoast region may soon experience water supply shortages. Currently there are no regional water resource plans that address the potential for a shortage. Because other communities rely on Madbury for water resources, regional cooperation and coordination of water use is critical. Water use and distribution should be equitable and sustainable. Equitable water use and management would provide Madbury with the opportunity to access the water resources within the town and be included in decisions regarding the town's resources. Water use should be sustainable, allowing for current water resource needs to be met without compromising the ability of future generations to meet their water resource needs. Effective water resource management requires regional coordination with equal voice given to all stakeholders. As the host of the Bellamy Reservoir and significant aquifers, Madbury holds a stake in the sustainable management of its water resources.

Between 1999 and 2002 Portsmouth is developing a 20-year Water System Master Plan which projects future growth of water demands on the Portsmouth water system. As of 2000 approximately 33,000 users are serviced by the Portsmouth water system. A preliminary draft of the Plan estimates over 12,000 new residents within the service area of the PWD by the year 2020. Portsmouth may look to increasing their withdrawal from the Bellamy Reservoir to provide for this growth. It is important for Madbury to contribute to the development this plan since it may have a direct impact on the Town's water resources. Issues regarding the sustainability of continued water resource development need to be addressed by this plan.

5.4.1. Regional Coordination

Regional coordination and management of water resources is essential since activity in Barrington, Dover, Durham, Lee, and Portsmouth will affect the same resources that are utilized by Madbury. Madbury and Dover share several important aquifers, and Madbury and Barrington share what is possibly an extensive drift aquifer. There are no significant, known aquifers shared with Lee or Durham.

Consistency in zoning and land use regulations along municipal boundaries is important for efficient resource management. Equal measures of protection on both sides of municipal borders should be provided to aquifers and watersheds. Dover's primary and secondary groundwater protection zones provide partial protection to aquifers which Dover and Madbury share. Madbury has the opportunity to aid in the protection of these important resources by instituting similar groundwater protection standards.

Recommendation: Negotiate, when needed, mutually beneficial municipal agreements that protect aquifers crossing municipal boundaries.

Recommendation: Coordinate water resources database management with state and Town boards to further the protection and management of the water resources of the Town.

Recommendation: Protect aquifers existing completely within the Town and cross-boundaries with other municipalities.

6. Assessment of Growth in Demand for Water

6.1. **Local projections.** Table 1.7 (Appendix 1) summarizes regional population growth estimates from 2000 through 2020. 1,509 people lived in Madbury in 2000, according to the 2000 Census. NH OSP projects the town population to be 1,733 by 2010 and 1,934 by 2020. [31] Madbury averaged 9 new housing starts per year over the 1990's. Currently, there are an estimated 493 dwellings in Madbury and 99% of these have their own well. Therefore, continued development at this rate would result in 180 new homes and 180 new wells by the year 2020. [32] There are no current data available on Madbury's per capita water use. Assuming a generic consumption rate of approximately 100 gallons per capita, Madbury's total annual residential consumption in 2010 would be approximately 63 million gallons. At full build-out conditions, the Town could reach a total population of about 5,700 people around the year 2130. This hypothetical maximum population estimate is based on current buildable land according to current zoning ordinances and septic specifications. An alternative build out estimate based on minimum lot sizes allowed by

current zoning ordinances is a maximum of 1,816 dwelling units in the year 2146. The maximum population and housing units in town could change due to alterations in zoning and septic regulations. [33] Build out projections can be combined with knowledge on local per capita water use and recharge to develop an understanding of Madbury's water resource needs over time.

There is some question as to what the sustainable yield is from aquifers in Madbury. With regional water use on the rise, Madbury's water resources are likely to be increasingly sought after. Careful planning would help ensure that Madbury's future water needs are met while balancing regional water demand.

There are several commercial and industrial establishments in Madbury, but with the possible exception of New England Metals (formerly Madbury Metals) and Pike Industries, none are intensive water users. No major commercial or industrial growth is expected in the foreseeable future.

Recommendation for further research: Study Madbury's per capita water use and groundwater recharge and estimate the effect that future population growth in town would have on groundwater supplies. Combine the results of this study with build out results to develop an understanding of Madbury's water resource needs vs. availability in the future.

6.2. **Regional projections.** The City of Portsmouth is projecting water use over the next 20 years in its Water Systems Master Plan. Otherwise, there is currently not a regionally based water resource plan that projects supply and demand into the future. Given the rapid growth in population and housing over recent years, a regional water budget is critical to sustainable water resources management in Madbury. It is in Madbury's interest to advocate for the development of a regional water resources management plan involving other municipalities, watershed planning agencies, regional planning commissions, the US Geological Survey (USGS) and NH DES.

Recommendation: Support the efforts of watershed associations, regional planning commission, and municipalities to coordinate water protection and management within the Bellamy and Oyster River watersheds. Incorporate actions, regulations, and policies from watershed management plans through the Planning Board, Conservation Commission, and Water District.

7. Community Infrastructure

7.1 Septic Systems. **Minimum lot size in Madbury's Residential and Agricultural District is 80,000 square feet. Of this area, 25% or less of the lot may be rated as undevelopable due to steep slopes, hydric soils, or other factors. The Town minimum lot size standard does not include hydric A soils or surface water. Therefore, lots with hydric A soils or surface water will have a larger minimum lot size. Adequate lot size helps to ensure proper function of septic systems. Since Madbury relies exclusively on septic systems, strict adherence to septic system regulations is critical to protecting both drinking water and in the Bellamy River, Oyster River, and Great Bay ecosystems.**

7.2. Solid Waste Facilities. There are no active solid waste facilities in Madbury. However, an unlined town landfill is located on the south side of Pudding Hill road near the intersection with Evans Road. There is potential at this site for contamination of ground and surface water. Transmissivity is an important factor in groundwater pollution. The more quickly water passes through an area, the wider the spread of contamination plume and the more quickly this spreading occurs. The landfill lies above the southwestern edge of the Pudding Hill Aquifer in an area classified by the USGS as having a transmissivity rate between 500 and 1000 square feet per day. Although this is not the highest rating, this rate does indicate that contamination plumes in groundwater could spread quickly. The town landfill is also located near the headwaters of Gerrish Creek, which feeds directly into the Oyster River and the Little Bay Estuary through Johnson Creek. Both the Pudding Hill Aquifer and Gerrish Creek are important resources to Madbury as well as other communities in the region.

Recommendation for further research: Identify alternatives to monitoring groundwater in the Pudding Hill Aquifer as well as Gerrish Creek in order to detect potential contamination.

8. Existing Programs and Policies

8.1 Existing ordinances and regulations

8.1.1 Erosion and sedimentation prevention. Madbury's Subdivision Regulations stipulate that new housing developments take steps to prevent erosion and sedimentation due to stormwater runoff. [34]

8.1.2 Surface water flows. All land areas within 300 feet of the Bellamy Reservoir, 100 feet from the Bellamy and Oyster Rivers, and 50 feet from all other brooks contain specific restrictions such as the maintenance of a 50 foot buffer of natural vegetation, limitations on forestry, and structure setbacks which are aimed at preserving water quality and conserving habitat. [35]

8.1.3 Flood storage capability. Madbury has adopted a Wetland Conservation Overlay District as part of the zoning ordinances to protect wetland areas. Since most floodplains are within wetland areas, by protecting wetlands the town is providing partial protection from flood events. [36]

8.1.4 Prevention of wetland encroachment. Madbury's Wetland Conservation Overlay limits construction or disturbances allowable in wetland areas. [37]

8.1.5 Prevention of excessive nutrient levels. The 80,000 square feet minimum lot size requirement for residential-zoned areas reduces non-permeable surface expansion and helps ensure that adequate distance separates septic systems. The Town restricts the proximity of new sewage systems and leach fields to groundwater and wetlands. [38]

8.1.6 Protection of wildlife and fisheries habitat. The Wetland Conservation Overlay District and Shoreland Protection District call for the protection of existing wildlife habitat. Shore-based

pollution of surface water is minimized, thereby helping to protect the Great Bay and Little Bay Estuaries in addition to town surface water. [39]

8.2 Programs outside of Madbury

8.2.1. NH Estuaries Project and Coastal Program. Recently the NH Estuaries Project (NHEP), administered by NH OSP, identified and recommended various water quality and habitat protection goals and action plans that are considered necessary to protect the aquatic and shoreline resources of the Great Bay Estuary and other coastal waters. [40]

8.2.2. Watershed planning initiatives. Watershed planning initiatives provide a regional perspective on water resource management and protection. Watershed planning is one way in which members of different communities can come together to solve water resource related issues. Madbury has extensive water resources and the participation of Madbury's citizens in watershed planning initiatives is important.

8.2.2.1. Oyster River Watershed Association. The Oyster River Watershed Association (ORWA), formed in 1999, is a volunteer-run organization co-founded by the Strafford Conservation District and Strafford Regional Planning Commission. ORWA's mission is to protect, promote, and enhance the ecological integrity and environmental quality of the Oyster River Watershed through land protection and education.

8.2.2.2 Bellamy River Watershed. There is no similar watershed planning initiative in the Bellamy River Watershed as of June 2001. However, an initiative similar to the ORWA is under consideration. The Town's participation in an association of this kind is vital if the management and monitoring of the Bellamy River Watershed is to involve all stakeholders and work toward sustainability of the resource.

Recommendation: Madbury should become an active and vocal stakeholder in Bellamy River Watershed planning and management.

8.3 Other State or Regional Protection Programs. At the State level, NH DES administers several programs designed to protect surface water quality. Some of the programs most pertinent to Madbury include the Non-point Source Pollution Assessment Program, the Site Terrain Alteration Permit Program, the Protection of the Purity of Surface Water Supplies rule (Env-Ws 386) and the Surface Water Classification System. Each program is summarized below:

8.3.1 Protection of the Purity of Surface Water Supplies. [41] This program, commonly referred to as the State Watershed Rule, enables a water supplier or municipality to develop watershed protection requirements for a surface water supply particularly where watersheds extend into other municipalities. Once approved by NH DES, the protective provisions are then adopted as part of NH DES's administrative rules, with the water supplier remaining as the principal enforcer. Currently, there are 30 out of 57 active surface water sources statewide that have adopted some level of protection under this rule. The requirements generally include the use of buffer zones with widths typically ranging between 75 to 200 feet, various land use restrictions and some prohibit boating or swimming. This rule enables municipalities to broaden

the use of storm water treatment devices, buffer zones, infiltration measures for ground water recharge, or other land use restrictions to protect the quality of the water supply where such measures would not otherwise be required by other state or local environmental regulation.

8.3.2 Surface Water Quality Standards. [42] NH DES has established water quality standards that are applicable to all surface waters. These standards are usually numerical limits for various parameters, including E. coli bacteria, nutrients, turbidity, temperature, pH, dissolved oxygen, and various metals and other toxic substances. Certain activities that have the potential to degrade water quality and to cause instream concentrations to exceed these standards are prohibited. These standards are tied to two water use classifications. Class A waters are considered to be the highest quality and are generally acceptable for use as public drinking water sources after filtration and disinfection. Discharge of any sewage or wastes is prohibited in Class A waters. Class B waters are considered to be the second highest quality and are generally acceptable for bathing and other recreational purposes, and for use as water supplies after adequate treatment. The upper Bellamy River Watershed is the only water body designated as Class A water in Madbury. The other water bodies in Madbury are considered to be Class B waters. The State periodically assesses whether these criteria are being met and reclassifies surface water bodies.

8.3.3. Site Alteration ("Site Specific") Program. NH DES has jurisdictional review and a permitting process for all land development activities that will disturb an area of more than 100,000 square feet, or 50,000 square feet in locations within 250 feet of a designated public water body, to insure that adequate erosion control and storm water management measures will be implemented to treat runoff before it leaves the proposed site. The selection and the design of the various treatment devices available should be done in accordance with state standards. [43]

8.3.4 River Protection and Management Act. [44] Under this program river segments may be nominated by communities or citizens, then designated by NH DES to receive additional protection against discharges, land use activities along the shoreline, flow alterations and water withdrawals. Of the twelve river segments currently protected under this program, there are none that pass through Madbury.

Instream flow is one of the key protection measures provided by this act. The act gives NH DES the authority and responsibility to maintain flow to support instream public uses in rivers that have been designated by the Legislature for special protection under RSA 483. Instream public uses are defined as including navigation, recreation, fishing, conservation, maintenance and enhancement of aquatic life, fish and wildlife habitat, protection of water quality and public health, pollution abatement, aesthetic beauty, and hydropower production.

NH DES recently issued a 401 certification (water quality) for Durham's withdrawal from the Lamprey River. The certification limits downstream flow depending on the amount of water flowing in the river. This method is likely to be the state practice for issuing 401 certifications in the near future. Calculations that represent current flow rates are used to identify withdrawal restrictions and cessation. The Bellamy River 401 certification will likely be modeled similarly to the Lamprey River model.

8.4 Water Law and Water Rights. The legislature, Governor, and Public Utilities Commission have the power to transfer water rights. The City of Portsmouth owns the water rights to the Bellamy Reservoir, and that no one else is authorized to take water from the reservoir. According to state law, Portsmouth must supply adequate flow downstream of its dam, however there are no standards set for adequacy. Any surface water user must report to the NH DES if withdrawal exceeds 600,000 gallons in a 30-day period or 20,000 gallons per day averaged over seven consecutive days. Riparian landowners have the right to reasonable use of the public waters of New Hampshire. Although Madbury owns several lots on the Bellamy Reservoir, the town has no riparian rights due to a sanitary easement owned by Portsmouth. Easement and flowage rights were transferred to the city of Portsmouth by a contract with the United States of America on January 27, 1954. [45]

Recommendation for further research: Determine whether Madbury may or may not secure a right to Bellamy surface water.

Appendix 1: Tables

Table 1.1: WATERSHED SUMMARY

Watershed	Bellamy River	Oyster River	Little Bay
Area	33.86 sq. miles	30.98 sq. miles	1.78 sq. miles
Origin	Swains Lake, Barrington	Near Creek Pond, Barrington	-none-
Terminus	14 miles east to Little Bay at Clements Point, Dover	13 miles east to Little Bay at Durham Point	2 unnamed streams enter the Bay in Madbury at Royalls Cove
Drainage area	Barrington, Madbury, Dover, Lee	Barrington, Lee, Madbury, Durham, Dover, Nottingham.	Dover, Madbury, Durham, Newmarket, Stratham, Greenland, Portsmouth, Newington
Impoundments	4 dams: Swains Lake, Barrington; Bellamy Reservoir, Madbury; 2 locations in Dover.	2 dams in Durham.	-none-
Other features	Mallego Brook & tributaries; Bumford Brook & tributaries; Pierce Brook & tributaries; Kelly Brook; Knox Marsh Brook; Winkley Pond; Barbadoes Pond.	Turtle Pond; Caldwell Brook; Chelsey Brook; Beards Creek & tributaries; College Brook; Johnson Creek; Gerrish Brook & tributaries; Hoyt Pond; Bunker Creek; Smith Creek; Longmarsh Brook; Hamel Brook; Horsehide Brook.	Eight minor streams.
Maximum elevation	514 feet at Sunnyside Hill, Barrington.	601 feet at Bumfagging Hill, Barrington.	120 feet at an unnamed hill along the Madbury/Dover border.
Major surface waters	Bellamy River, Swains Lake, Bellamy Reservoir.	Oyster River, Wheelwright Pond, and Durham Reservoir.	Little Bay.
Classification	Class A, B*	Class A	Class B

SOURCES: NH GRANIT digital Watersheds layer. Watersheds delineated by NHDES; 1990 Madbury Master Plan; *Strafford Region Natural Resources Inventory,* SRPC, 12/98. * The portion of the watershed downstream from Dover's point of withdrawal is Class B as defined in RSA 149:3. Above this point the Bellamy is rated Class A.

Table 1.2: SURFACE WATER BODIES

Water Body	Watershed	Elevation	Area (acres)	NH DES Water Quality	Primary Consumer	Consumption Rate	Threats
Barbadoes Pond	Bellamy	132 ft.	16 a		Pike Industries		Hydromining
Bellamy Reservoir	Bellamy	125 ft.	323.9 a	Class A	Portsmouth	2.25 Mgal/day	Dover landfill
Bellamy River	Bellamy	125 to 90 ft.	36.6 a	Class A	Dover	.72 Mgal/day	Depletion
Hoyt Pond	Oyster	60 ft.	2 a		none		
Other water bodies	-	-	17 a	Class A	UNH		

SOURCES: *Strafford Region Natural Resources Inventory*, SRPC, December 1998; Dover Master Plan, 2000.

Table 1.3: WATERBODY CHARACTERISTICS

Characteristic	Barbadoes Pond	Bellamy Reservoir	Hoyt Pond
Area:	16 acres	323.9 acres	2 acres
Length:	-	12.8 miles	-
Elevation:	135 feet ASL	125 feet	40 feet
Average Depth:	-	-	6 feet
Maximum Depth:	48 feet	-	10 feet
Color:	colorless	brown	brown
Bottom:	100% sand	mucky	90% clay
Emergent Vegetation:	abundant	common	scant
Submerged Vegetation:	common	common	scant
Shore:	sand & wooded	gravel & rocky	-
Watershed	Bellamy R.	Bellamy R.	Oyster R.

SOURCES: Inventory of Lakes, Ponds, and Reservoirs in Strafford County, Strafford County Conservation District, date unknown, but after 1963; Biological Inventory of Lakes and Ponds in Sullivan, Merrimack, Belknap, and Strafford Counties, NH Fish & Game Department Survey Report No. 8b, 1963; Water Resources Chapter, Regional Master Plan, SRPC, 1990; and *Strafford Region Natural Resources Inventory*, SRPC, December 1998.

Table 1.4: WETLAND AREA SUMMARIZED BY WETLAND SIZE

Acres	Number of Areas	Total Area (Acres)	Average Size (Acres)
200 +	2	529	264.5
100 to 199	2	314	157
50 to 99	14	930	66.4
20 to 49	12	346	28.8
5 to 19	15	135	9
0 to 4	15	31	2
Total	60	2285	87.95

SOURCE: *Wetlands of Madbury*, 1988, D. Allan.

Table 1.5: SUMMARY OF THE SAFE SUSTAINED YIELD FOR LOCAL AQUIFERS

Town	Aquifer Number	Surficial Area (Sq. M)	Gallons Per Day	Storage Volume	Induced Infilt gpd	Sust. Yield mgd
Dover	DO-1	0.23	82,874	82,784		0.16
	DO-2	0.86	309,539	309,539		0.62
Madbury	MA-1	0.20	71,896	71,896	55,584	0.20
	MA-2	1.10	395,922	395,922	72,800	0.72

SOURCE: US Army Corp of Engineers, NE Division, "Groundwater Assessment, Southeastern New Hampshire Water Resources Study," 1981 in *Regional Master Plan, Water Resource Chapter,* SRPC, 1990.

Table 1.6: REGIONAL WATER SYSTEM SUPPLY/DEMAND SUMMARY

		Current Supply Capacity (mgd)		Max Daily
Water System	Wells	Surface Water	Total	Demand (mgd)
Dover Water Department	3.29	0.00	3.29	3.60
Durham/UNH Water Department	0.50	1.55	2.05	1.70
Pease Trade Port	1.25	0.00	1.25	0.20
Portsmouth Water Department	2.28	4.00	6.28	6.10

Table 1.7: REGIONAL GROWTH STATISTICS

	2000	2005	2010	2015	2020
Barrington	7,475	7,438	7,648	8,056	8,510
Dover	26,884	28,562	29,205	30,389	31,704
Durham	12,664	12,438	12,737	13,285	13,894
Lee	4,145	4,452	4,606	4,913	5,254
Madbury	**1,509**	**1,684**	**1,733**	**1,828**	**1,934**

SOURCE: 2000 US Census; 1997 NH OSP Population Projections.

Appendix 2: PUBLIC DRINKING WATER SUPPLIES

Report produced 10 January 2001 NHDES Water Supply Engineering Bureau

PWSID	SYSTEM NAME	ADDRESS	TOWN	SYS TYP	SYS ACT	SRC TYP	SRC ACT	SOURCE DESCRIPTION	WD	POP SERV
0651010-011	CITY OF DOVER WATER DEPT	RIVER ST	DOVER	C	A	E	A	GRIFFIN WELL TREATMENT PLANT, MAST RD	0	26000
1455010-001	MOHARIMET SCHOOL	RTE 155	MADBURY	P	A	G	A	BRW 1, 650' SOUTHWEST OF SCHOOL	775	500
1455010-002	MOHARIMET SCHOOL	RTE 155	MADBURY	P	A	G	A	BRW 2, 800' SOUTHWEST OF SCHOOL	200	500
1456010-001	ELLIOTT ROSE COMPANY/ MADBURY	RTE 155	MADBURY	P	I	G	A	BRW 1, 120' SW OF SW CORNER OF HOME	280	15
1456010-002	ELLIOTT ROSE COMPANY/ MADBURY	RTE 155	MADBURY	P	I	G	I	BRW 2, 300' W OF SW CORNER OF HOME	0	15
1457010-001	OLD STAGE CAMPGROUND	OLD STAGE RD	MADBURY	N	A	G	A	BRW, LOCATED NEXT TO PUMPHOUSE	360	150
1457020-001	TENNIS COOP INC	GARRISON CIR	MADBURY	N	A	G	A	BRW, 60' S OF BUILDING ENTRANCE	0	125
1457030-001	NEW ENGLAND SPORTS ACADEMY	282 KNOX MARSH RD	MADBURY	N	I	G	A	BRW, 120' E OF BUILDING	280	150
1458010-001	MOLLY OS II	316 ROUTE 108	MADBURY	N	I	G	I	WELL	0	75
1458010-002	MOLLY OS II	316 ROUTE 108	MADBURY	N	I	G	A	BRW, 15' ESE OF SW BLDG CORNER	720	75
1459010-001	COTTAGE BY THE BAY	PISCATAQUA RD	MADBURY	N	A	G	A	BRW 300' WNW OF NW CNR BLDG	440	200
1951010-001	PORTSMOUTH WATER WORKS	FRESHET RD	PORTSMOUTH	C	A	E	A	TREATMENT PLANT (FINISHED)	0	33000
1951010-005	PORTSMOUTH WATER WORKS	FRESHET RD	PORTSMOUTH	C	A	G	I	MADBURY 1 (NOT OPERATIONAL)	0	33000
1951010-006	PORTSMOUTH WATER WORKS	FRESHET RD	PORTSMOUTH	C	A	G	A	MADBURY 2	0	33000
1951010-007	PORTSMOUTH WATER WORKS	FRESHET RD	PORTSMOUTH	C	A	G	A	MADBURY 3	0	33000
1951010-008	PORTSMOUTH WATER WORKS	FRESHET RD	PORTSMOUTH	C	A	G	A	MADBURY 4	0	33000
1951010-009	PORTSMOUTH WATER WORKS	FRESHET RD	PORTSMOUTH	C	A	S	A	BELLAMY RESERVOIR	0	33000

NOTES:

PWSID System-Source ID number
TOWN Town served by the source
SYS TYP System Type:
"C" = Community public water systems which serve at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents
"P" = Non-transient, Non-community systems which are not community systems and which serve the same 25 people or more over 6 months per year
"N" = Transient public water systems serving 25 people or more per day for 60 days or more per year, but not the same people every day –
(Examples include restaurants and hotels with fewer than 25 employees)
SYS ACT Active status of the System ("A" = active; "I" = inactive)
SRC TYP Source Type ("S" = surface water; "G" = groundwater; "E" = entity/treatment facility)
DESCRIPTION Description of the source ("BRW" = bedrock; "ART" = artesian; "GRW" = gravel; "GPW" = gravel packed; "INF" = infiltration; "PH" = pump house)
WD Well depth in feet
POP SERV Population served by the System

Appendix 3: DAM PERMITS

Source: New Hampshire Department of Environmental Services, 3/7/2001.

Dam #	Name	River	Hazard Classification	Height (feet)	Impounded Area (acres)	Type	Basin	Owner
148.01	BELLAMY RIVER	BELLAMY RIVER		5.5	0	CONCRETE	PISC	TOWN OF MADBURY
148.02	FIRE POND			3		EARTH	PISC	TOWN OF MADBURY
148.03	BEARD CREEK	BEARDS CREEK		6.5	2	EARTH	PISC	RONALD TUVESON
148.04	BELLAMY RIVER	BELLAMY RIVER		2.5	0.2	EARTH	PISC	UNH KINGMAN FARM
148.05	FIRE POND	UNNAMED STREAM	AA	8	0.38	EARTH	PISC	NICHOLAS ENGALICHEV
148.06	FARM POND	NATURAL SWALE	AA	7	0.75	EARTH	PISC	G. DREW & H. ARMITAPE
148.07	FARM POND	NATURAL SWALE	AA	10	0.21	EARTH	COAS	ARNOLD REDFEARN
148.08	HOYT POND	GERRISH BROOK	AA	12	0.4	EARTH	PISC	NH FISH & GAME
148.09	FARM POND	NATURAL SWALE	AA	5	0.48	EARTH	PISC	JESSE GANGWER
148.10	FARM POND	UNNAMED STREAM	AA	5	0.35	EARTH	PISC	JOSEPH MORIARTY
148.11	CONSERVATION POND	NATURAL SWALE		3	0.4	EARTH	PISC	RUTH MURRAY
148.12	FARM POND	NATURAL SWALE	AA	9	0.32	EARTH	PISC	JONATHON E BERRY
148.13	BELLAMY RESERVOIR DAM	BELLAMY RIVER	C	38.5	333	EARTH/CONC	PISC	CITY OF PORTSMOUTH
148.14							COAS	
148.15							PISC	PATRICIA HALE
148.16	WILDLIFE POND	NATURAL SWALE	A	8.5	5	EARTH	PISC	JESSE GANGWER
148.17	FARM POND	NATURAL SWALE	AA	8	0.25	EARTH	PISC	UNIVERSITY OF NH
148.18	FARM POND	NATURAL SWALE	AA		2.7	EARTH	PISC	WILLIAM F HOPKINS JR
148.19	JOHNSON BROOK	JOHNSON BROOK		8.5	1.5	EARTH	PISC	CITY OF PORTSMOUTH
148.20	FARM POND	NA	AA	10	0.3	EARTH	PISC	ROSE LAWN FARM
148.21							COAS	
148.22	FARM POND	NATURAL SWALE	AA	5.5	2	EARTH	PISC	TOM SHIRLEY
148.23	CORNWELL WILDLIFE POND	UNNAMED WETLAND	AA	5.9	0.33	EARTH	COAS	KATHERINE CORNWELL

Appendix 4: GROUNDWATER HAZARD INVENTORY

SOURCE: *Site Remediation and Groundwater Hazard Inventory, Madbury*. 10/24/00. <http://www.des.state.nh.us>

Site #	Site Name	Site Address	Permits	Project Type	Project Manager
198403036	Madbury Brush & Stump Dump	Pudding Hill Road	0	Stump/Brush dump	Unassigned
198705022	Madbury Metals, Inc.	Rte. 155	2	Unlined landfill	Permits-Management
			2	Groundwater Release Detection Permit	Permits-Release Dept.
198801010	City's Water Treatment Plant	Freshet Road	0	Unlined landfill	Unassigned
			0	Special projects	Locker
198809005	Oyster River School District - Elem. Sch.	Rte. 155	0	Underground injection control	Closed
198903053	Kingman Farm	Rte. 155	0	Sludge application projects	Closed
199191013	Carbone Property - Formerly Garrison Motors	191 Littleworth Road	0	Leaking Underground storage tank	Closed
199410032	B & B Printing	314 Route 108	0	Underground injection control	Closed
199411014	Elliot Rose Co.	Rte. 155	0	On-premise use facility containing fuel oil	Closed
199610011	Martel Dump Site	Pudding Hill Road	0	Unlined landfill	Rydel
199712010	Robert Gaetjen	65 Nute Road	0	On-premise use facility containing fuel oil	Unassigned
199803002	Pike Industries, Inc.	Route 9	0	Registered above-ground storage facility	Willis
199906053	Madbury Alum Drying Beds	Freshet Road	1	Sludge application projects	Permits-Discharge
199906058	Mrs. Robert Jones Residence	1 Freshet Road	0	On-premise use facility containing fuel oil	Closed
200001047	Madbury Wells 2 & 3	Freshet Road	0	Underground injection control	Closed
200003004	New England Metal Recycling	290 Knox Marsh Road	0	Registered above-ground storage facility	Willis

Appendix 5: UNDERGROUND STORAGE TANK REGISTRATION LISTING

SOURCE: NH Department of Environmental Services web site, 10/24/00.

Name	Owner	Permit #	Location	Tank #	Capacity	Tank Type	Substance Stored	Installed	Date Closed	Closed Type
Madbury Metals, Inc.	Madbury Metals, Inc.	0-1122342	Knox Marsh Road	1	10,000 g	Steel	#2 Heating Oil	Oct. 1974	Oct. 1993	Removed
				2	10,000 g	Steel	#2 Heating Oil	Aug. 1979	Oct. 1993	Removed
Madbury Water Treatment Plant	City of Portsmouth	0-113635	Freshet Road	1	5,000 g	n/a	#2 Heating Oil	Jan. 1960	Nov. 1989	Removed
				2	8,000 g	Steel	Hazardous Substances	Jan. 1980	Sep. 1998	Removed
				3	**8,000 g**	**Composite**	**Hazardous Substances**	**Oct. 1998**		
Susan Warner Smith		0-114265	Littleworth Road	1	550 g	Steel	Gasoline	n/a	May. 1992	Removed
Town of Madbury		0-112539	Town Hall Road	1	2,000 g	Steel	#2 Heating Oil	Mar. 1985	Aug. 1998	Removed

General Reference List

Biological Inventory of Lakes and Ponds in Sullivan, Merrimack, Belknap, and Strafford Counties, NH Fish & Game Department Survey Report No. 8b, 1963.

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Endnotes

[1] *Strafford Region Natural Resources Inventory*, SRPC, December 1998.
[2] *NH Department of Environmental Services Factsheet # WB 7,* http://www.des.state.nh.us/factsheets/wetlands/wb-7.htm (1/31/2001).
[3] *NH Department of Environmental Services Factsheet # WB 7,* http://www.des.state.nh.us/factsheets/wetlands/wb-7.htm (1/31/2001).
[4] In *Wetlands of Madbury,* David Allan, 1988, wetlands were delineated using soil type data from the *Soil Survey of Strafford County, NH* (USGS, 1973).
[5] *Strafford Region Natural Resources Inventory*
[6] *Strafford Region Natural Resources Inventory*
[7] *Wetlands of Madbury*
[8] From *Portsmouth Water and Sewer Rate Study,* June 1995.
[9] NH Env-Ws 1703.01, Water Use Classifications
[10] Dover Master Plan, 2000
[11] *Dover Master Plan*, 2000
[12] Nerney, Scott R. *1989 & 1990 Well Water Quality Surveys.* April 1992.
[13] This map is part of the report *Geohydrology and Water Quality of Stratified-Drift Aquifers in the Bellamy, Cocheco, and Salmon Falls River Basins* by T.J. Mack and S.M. Lawlor of the USGS. Additional information is also available from a similar report on the Oyster River Basin.
[14] Medalie, L. and Moore, R., USGS. *Ground-Water Resources in New Hampshire: Stratified Drift Aquifers.* 1995, in *Strafford Region Natural Resources Inventory* p. 21.
[15] Transmissivity is defined as the rate at which water passes through a unit width of an aquifer.
[16] *Radon Concentrations in the Groundwater, Madbury, New Hampshire*, November 1994, Ellen Douglas for the Madbury Water District.
[17] According to Rick Chormann at DES, 4/2000.
[18] From *Geology and Near Surface Aquifer Potential of Madbury,* NH, AMI, Inc., 1988, and Cotton, John E. *Availability of Groundwater in the Piscataqua and Other Coastal River Basins, Southeastern New Hampshire*. Water Resources Investigations 77-70, USGS, 1997.
[19] *Geology and Near Surface Aquifer Potential of Madbury*
[20] According to Tom Mack, Geohydrologic Section Chief for the United States Geologic Survey's NH-VT District, 3/2001.
[21] NH Code of Administrative Rules, Pln 401.33.
[22] NH Code of Administrative Rules, Pln 401.25
[23] NH Env-Wm 1401.26, Leak Monitoring for New Tanks
[24] From *Opinion on the Effect of the Proposed Iafolla Below Water Table Mining Proposal*, Thomas Ballestero, a former director of the New Hampshire Water Resources Research Center and current faculty member at UNH.
[25] *Fact Sheet,* Iafolla Industries.
[26] *NH Department of Environmental Services Factsheet: Sodium and Chloride in Drinking Water, # WD-WSEB-3-17,* http://www.des.state.nh.us/factsheets/ws/we-3-17.htm (1/23/2001).
[27] In August 2000 Ellen Douglas, P.E. completed the report *Volatile Organic Compounds in Private Drinking Water Wells: A Town-Wide Survey for Madbury, New Hampshire,* for the Madbury Water District.
[28] New Hampshire Revised Statutes Annotated (RSA) 485-A: 2
[29] In accordance with the Alteration of Terrain Program (RSA 485-A: 17 and Env-Ws 415).
[30] Paragraph (d) of Env-Ws 1703.01 Water Use Classifications
[31] NH OSP Population Projections, 1997
[32] *Madbury Build-Out Study*, SRPC, March 1999.
[33] *Madbury Build-Out Study*
[34] Madbury Subdivision Regulations, Article V, Sect. 18
[35] From the Madbury Shoreland Protection Overlay District, Article X, Sect. 4 and 5

[36] Wetland Conservation Overlay District, Article IX, Sect. 3
[37] Wetland Conservation Overlay District
[38] Building Regulations and Subdivision Regulations
[39] Wetland Conservation Overlay District and Shoreland Protection District
[40] The NHEP Management Plan (draft) draws from various studies and monitoring activities and identifies numerous action plans to improve or protect resources.
[41] Env-Ws 386
[42] Env-Ws 430
[43] Information on state standards can be found in *NH Storm Water Management and Erosion Control Handbook for Urban and Developing Areas in New Hampshire* (referred to as the "Green Book").
[44] RSA 483
[45] The 1998 *Bellamy River Water Rights Report* by Holly Gallagher, EIT provides documentation of Madbury's current water rights on the Bellamy River according to state law and contractual agreements.