



COMPREHENSIVE
SOURCE PROTECTION PLAN
Pond Road and Bolton Road Wells
Harvard, Massachusetts

PWS ID No. 2125000

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TABLE OF CONTENTS

1.0 Acknowledgements..... 1

2.0 Background/Objectives..... 1

3.0 Description of Water Supplies..... 3

Water Supply Sources 3

Water Quality Testing Results 6

Hydrogeologic Settings..... 7

Bedrock Aquifers..... 7

Surficial Geology..... 9

Hydrology & Groundwater Flow..... 10

Ecosystems..... 11

Other Public Water Suppliers..... 11

Source Protection Areas 11

Zoning Classifications 13

Zone I Ownership/Control..... 13

4.0 Water Supply Protection Issues 13

Potential Contamination Source Identification 13

Pollution Susceptibility Assessment..... 16

Future Land Uses & New Water Supplies 21

Local Regulatory Controls & Plans 23

Sanitary Survey Results..... 26

5.0 Recommended Protection Measures, Committee & Schedule 27

Protection Measure Recommendations 28

Supplier-Owned Properties 28

Other Properties 36

Protection Committee Recommendations..... 41

Protection Recommendations Summary & Schedule..... 42

6.0 Supplemental Contingency Plan 45

Incident Documentation..... 46

Emergency Identification..... 46

Response Team Activation..... 46

Notification Procedures..... 46

Corrective Actions & Alternative Water Sources..... 49

Contingency Recommendations Summary..... 54

7.0 References..... 55

Appendices

- Appendix A Figures (*including Site Locations, Bedrock Geology, Potential Sources of Contamination, Land Uses & Wetlands and Property Boundaries*)
- Appendix B Potential Sources of Contamination Inventories
- Appendix C Abbreviated Source Protection Plans (*including DEP Certification Forms, Abbreviated Source Protection Plans and Source Protection Area Maps*)
- Appendix D Landowner List, Example Notification Letters & Example Indoor Posting
- Appendix E Officials List & Example Notification Letter
- Appendix F Emergency Response Information

1.0 Acknowledgements

Funding for this project was provided through a United States congressional appropriation to the National Rural Water Association and the Mass Rural Water Association (MassRWA) and was administered in cooperation with the U.S. Environmental Protection Agency (EPA).

MassRWA wishes to thank all the individuals and organizations that contributed to this effort, including Water Commissioner Dave Swain who generously provided helpful information regarding site characteristics, water system history and potential sources of groundwater contamination. In addition, other local officials cheerfully assisted us with mapping and database information, and the Massachusetts Department of Environmental Protection (DEP) provided invaluable technical assistance and guidance.

MassRWA would also like to acknowledge the important role that drinking water suppliers play in safeguarding public health and our natural resources. They harbor the very difficult task of balancing water withdrawals for public consumption with responsible stewardship of our natural resources, on a daily basis.

2.0 Background/Objectives

A Source Protection Plan (SPP) identifies water system vulnerabilities to contamination and describes techniques to manage potentially contaminating land uses. This SPP was specifically developed by MassRWA at the request of the Harvard Water Department (HWD) to aid in the protection of the public water system (PWS) that serves the Town of Harvard, Massachusetts.

Public water suppliers around the state and across the nation are increasingly finding that proactive planning and prevention are essential to both the long-term integrity of their water systems and the limitation of their costs and liabilities. Despite our best efforts, accidental spills of hazardous chemicals are all-too-common and bacterial outbreaks still occur unexpectedly, sometimes with disastrous consequences. These types of events may result in costly treatment, remediation and/or litigation, and in a worst-case scenario could permanently destroy a water source or injure/kill a water customer.

According to the National Center for Small Communities (2000), successful planning and prevention requires six basic steps:

- Source protection area (SPA) delineation;
- Identification of sources of contamination within SPAs;
- Assessment of the risks to drinking water posed by contaminant sources;
- Publication of the risk assessment results;
- Implementation of measures to manage contaminant sources; and
- Contingency planning for response to contamination incidents.

As a first step toward drinking water protection planning on a statewide basis, DEP has completed Source Water Assessment & Protection (SWAP) reports for most Massachusetts PWSs. The SWAP reports include descriptions of SPAs and land uses which may potentially contaminate water sources, as well as recommendations for managing those land uses. Consequently, the reports provide water suppliers with an important tool for initiating or improving source water protection efforts in their area.

The SWAP report for HWD highlights the special needs for drinking water protection at Town facilities (DEP, March 26, 2001). The overall ranking of source susceptibility to contamination was “**High**” at those facilities, based on reviews of SPA land uses. As a result of that study, DEP recommended that the Town implement a number of best management practices (BMPs) and other protection measures including local bylaw reviews, land use (contaminant threat) inventories, regular SPA inspections, emergency plan updates and coordination with local citizens and officials.

This document supplements and expands upon those recommendations, in accordance with applicable state guidelines (DEP, November 2001). Detailed information on local drinking water quality is provided, as well as the results of a comprehensive SPA inspection and suggestions for working with stakeholders. Basic descriptions of the sources and their SPA delineations are provided in Section 3.0. An assessment of potential sources of contamination (PSOCs) and system vulnerabilities is contained in Section 4.0. Specific recommendations and a proposed schedule to manage potential threats are provided in Section 5.0, and a contingency plan for system emergencies is included in Section 6.0.

While drinking water quality has been the traditional focus of source protection efforts, contamination is not the only source protection concern. Maintaining adequate water yields as land uses intensify within or near an SPA can be a challenge also. A system owner can have excellent water quality, but if their source can't meet the demand placed upon it then source improvements or replacement may be necessary. Consequently, this SPP also includes aquifer and well yield descriptions, an assessment of system vulnerabilities to declining yields and recommendations for managing those vulnerabilities.

To maintain the safety of these PWSs and limit system liabilities, the Town should strive to consider and implement the recommendations provided in this plan. Source protection planning is currently not a requirement for this system. However, it is clearly in the water supplier's best interest to protect its drinking water, from a variety of perspectives. Most importantly, protection improves confidence that there will continue to be drinking water sources. Protection also reduces the likelihood that contamination incidents will occur with costly or harmful results. Regulators, customers and the public are interested in protection. In addition, SPPs provide strong support to requests for financial assistance.

There are many resources available to the supplier interested in improving source protection, including organizations such as MassRWA and DEP as well as local health and water resource officials. While funding for source protection initiatives is relatively limited at present, state grant programs are periodically available and other creative funding options may be employed. Many of the recommendations provided herein are not expensive to implement, particularly when compared to the possible costs and liabilities associated with a contamination incident, a source failure or DEP/EPA violations.

3.0 Description of Water Supplies

This section of the SPP includes a brief description of the Town's PWS. Background information on recent water quality testing results, the local hydrogeologic setting and the SPA delineations is provided. The data contained in this section were used to assist in assessing system vulnerabilities as described in Section 4.0.

Water Supply Sources

The following information about the Town's water supply sources was obtained from conversations and meetings with HWD representatives, field observations during a site visit on October 27, 2005 and a variety of reports including a recent sanitary survey (DEP, May 20, 2005) and statistical report (HWD, March 24, 2006).

This system includes three sources owned by the Town and operated by HWD. The system is classified as a community (COM) system, with approximately 80 connections mostly serving a year-round population of approximately 200 residents in 62 homes and a seasonal population of approximately 770 students/officials at two public schools (Harvard Elementary School and The Bromfield School). Service is also provided to:

- Other municipal facilities (Town Hall, Fire Department, Police Department, Harvard Public Library (old/new) and The Hildreth House);
- A preschool (The Barn School);
- Three churches (The Evangelical Congregational Church, St. Theresa's Roman Catholic Church and Harvard Unitarian Church); and
- Local businesses (Hillside Garage, The General Store/Harvard Pharmacy/The Camera Center, Harvard Realty, Harvard Cleaners/Fiber Loft, James J. Hammond, Jr. Dentistry, Harvard Custom Woodworking/Alpha Associates/John H. Walker, DMD).

The drinking water sources are three bedrock wells located in Harvard as shown on Figure 1 (Appendix A). Pond Road Well #2 (PWS ID#2125000-02G) is situated on the north side of Pond Road less than ½-mile southwest of Harvard Center on a 1.1-acre parcel identified as Lot 16 on Harvard Assessor's Map No. 22A. Pond Road Well #5 (PWS ID#2125000-05G) is located on the western edge of the same parcel about 100 feet southwest of Well #2. Bolton Road Well #3 (PWS ID#2125000-03G) is situated off of the east side of Bolton Road about ¾-mile south-southeast of Harvard Center on a 16-acre parcel identified as Lot 25 on Harvard Assessor's Map No. 22.

According to DEP and HWD, well construction details are as follows:

- *Pond Road Well #2:* This active eight-inch diameter bedrock well was installed in the 1950's to a depth of 130 feet and deepened to a depth of 450 feet in 2001. Groundwater is pulled into the well using a three-horsepower (HP) submersible pump set at a depth of 410 feet.

- *Pond Road Well #5*: This active six-inch diameter bedrock well was installed in 1997 to a depth of 505 feet with 20 feet of casing. Groundwater is pulled into the well using a three-HP submersible pump set at a depth of 300 feet.
- *Bolton Road Well #3*: This eight-inch diameter bedrock well was installed in 1949 to a depth of approximately 250 feet with 42½ feet of casing and two feet of screen. Groundwater is pulled into the well for emergencies (only) using a three-HP submersible pump.

Pond Road Well #2 is situated inside an underground concrete equipment vault accessed by a concrete stairway with locked metal hatchway doors. Pond Road Well #5 is located outdoors inside a locked, gated metal security fence and connected to the equipment vault by underground piping. Bolton Road Well #3 is situated just outside a locked, single-story metal-sided pump house with a concrete slab floor.

The Pond Road wellheads extend two to three feet above grade and terminate in well-sealed sanitary steel caps. The Bolton Road wellhead was not observed during our site visit but extends at least several inches above grade and has a sanitary cap according to HWD.

Both the equipment vault and pump house contain a standard array of pipes, controls and valves. The pump house interior was not observed during our site visit. However, the equipment vault interior was observed to be clean, neat and dry. A portable dehumidifier is located inside the vault and no evidence of flooding was observed. Meter reading logs were posted in the vault but maintenance logs were not observed.

The vault access area and the nearby wellhead at Well #5 were free of excess vegetation during our site visit. The wellhead area at Bolton road was lightly overgrown with weeds during the visit.

No treatment is provided for the Pond Road wells. Five portable zeolite softening units were historically located in the Bolton Road pump house to remove dissolved iron and manganese. HWD currently maintains connections for the softeners but the equipment itself has been removed. HWD has arranged to acquire the softeners on short notice from a local vendor in the case of an emergency activation of Well #3.

The Pond Road wells and equipment vault are inspected weekly and a drinking water protection sign is posted near the site. The Bolton Road well and pump house are not frequently inspected however the site is visually assessed during routine inspections of the Town's water storage tank (described below). No drinking water protection sign was observed near the Bolton Road pump house.

According to HWD, the Pond Road wells have historically operated on an automatic timer set to run Well #2 and Well #5 from eight to 16 hours/day and adjusted as needed based on system pressure gauge readings. The Town recently installed telemetry equipment to replace the timer setup and improve system safety and efficiency. The equipment includes over three dozen alarms for storage tank levels, pump activity, unauthorized entries, etc. Once fully operational and calibrated, the equipment will monitor and control pump start-and-stop times and also notify Town officials in the event of a system emergency.

The Bolton Road well can be activated as a backup source during system emergencies with DEP approval. The well was last used during a dry period in the summer of 1999. Well #3 was also used during at least one other emergency in 1995-1996 due to falling yields at Well #2 (D.L. Maher Co., July 1997). In response to that situation, Well #5 was installed and Well #2 was deepened.

Water levels are not currently monitored at any of the wells.

Flow rates are metered at each of the Pond Road wells but not the Bolton Road well. According to HWD, new meters were installed at Wells #2 and #5 this past winter and the Town is developing a meter calibration program. Pump capacities range from approximately 15 gallons per minute (GPM) at Well #5 to 25 GPM at Wells #2 and #3. DEP-approved pumping rates at Wells #2 and #5 are 43,000 gallons per day (GPD) and 23,000 GPD, respectively. Well #3 does not have an approved pumping rate.

Historical pumping records show that total annual withdrawals from the Town's water system have increased from about 6½ million gallons in 1997 to 7½ million gallons in 2004. Between 2000 and 2005, the annual average daily demand ranged from 19,600 GPD to 20,900 GPD. Maximum daily demands of more than twice the average amounts were observed during that same period.

Approximately 9½ million gallons of water were withdrawn from the Pond Road wells in 2005. The heaviest demands occurred in fall/winter, with a maximum daily demand of 64,584 GPD occurring in December. According to HWD, the above-normal demand was caused by a significant water main leak that was repaired in January 2006 with MassRWA assistance. A similar event in August 2002 resulted in a maximum daily demand of approximately 45,000 GPD.

In response to DEP's sanitary survey recommendations, the Town has developed a routine leak detection survey program to minimize unnecessary demand and "unaccounted-for" water. Surveys are scheduled to be completed approximately every two years. All identified leaks will be quickly repaired.

Water from the wells is transferred underground via nearly thirteen miles of unlined cast iron, ductile iron, cement-lined ductile iron and copper water mains. No emergency interconnection is available. The nearest PWS of sufficient size to interconnect with HWD is Devens Mass Development (DMD). DMD Wells #01G and #02G are located over two miles to the northwest of the Pond Road wells.

One storage facility, the Bolton Road Storage Tank, is tied into the distribution system. This 25± year-old ground-level concrete tank pressurizes the system and has a total storage capacity of approximately 310,000 gallons. This represents between five and 16 days worth of water at the maximum and average withdrawal rates referenced above, well above the DEP-recommended two-day storage minimum.

Tank and line maintenance are a priority for the Town. The water storage tank was last cleaned and inspected on June 13, 2002. The Town routinely flushes the distribution system, including annual flushing of all dead ends. In addition, the Town is partway through

a five- to seven-year water main relining/replacement program including the installation of new mains to eliminate dead end distribution loops.

The Town completed a cross-connection survey in June 1997 and has installed all required backflow prevention equipment. In response to DEP's sanitary survey recommendations, the Town has developed a semi-annual testing program for all backflow prevention devices and is developing an annual cross-connection controls notification and education program for customers and local officials (via Consumer Confidence Reports or CCRs). All faulty cross-connection control devices are quickly repaired or replaced.

Water Quality Testing Results

The chemical and biological quality of the water drawn from a well can provide one indication of its vulnerability to contamination. Detections of organisms or chemicals in a source – even if the levels are not of concern for public health – can provide an early warning signal that local land uses may have a future impact on that source.

This PWS is sampled regularly by HWD and tested for possible impurities including microbial contaminants (coliform bacteria), volatile organic compounds (VOCs), synthetic organic compounds (SOCs), radionuclides, secondary contaminants such as sulfate and inorganic compounds (IOCs) such as sodium, nitrate, nitrite, arsenic, lead and copper. Most samples are submitted to Thorstensen Laboratory in Westford, Massachusetts. A summary of water quality testing results is provided below.

According to the 2005 sanitary survey (DEP, May 20, 2005) and a review of water quality files for the 1991-2005 sampling period at DEP's Worcester office on June 8, 2006, the quality of drinking water provided by the Town is currently considered acceptable for general human consumption per applicable DEP/EPA standards with the limited exception of sodium (see below). This conclusion is supported by the Safe Drinking Water Information System *Violation Report* (EPA, June 5, 2006) which shows that no violations of the federal health-based water quality standards were reported for the Town between 1993 and 2006.

EPA records further show that a total of 277 violations of federal monitoring and reporting criteria were documented for the Town during the 1994-2004 monitoring period. Over 90% of the violations represented failures to collect VOC and radionuclide samples. The remaining violations represented periodic failures to collect bacteria, perchlorate, lead, copper and nitrate samples and notify state officials and the public about sampling results.

All but two of the monitoring/reporting violations were classified as “non-significant” by EPA since the Town completed a large percentage of the required sampling during the applicable monitoring events. A notification violation in 2004 and a radionuclide sampling violation in 2003 were classified as “significant” by EPA because HWD failed to take a large percentage of required samples for the system during those periods.

According to the sanitary survey, the Town had addressed all of the above-referenced violations to DEP's satisfaction by May 2005 with the exception of associated public notification requirements and one round of perchlorate sampling. As of June 2006, the Town

has followed up on all of those outstanding public notification and sampling requirements and made major improvements in operations staff and management.

At DEP's request, the Town is in the process of submitting information to verify that the Pond Road wells are not under the influence of surface water. Microscopic particulate analysis (MPA) testing was completed at Well #2 in July and December 1996 and May 2005 and Well #5 in May and September 2005. In addition, MPA testing was completed at one of the two Pond Road wells (presumably Well #2) in September 2003 and June 2004. All MPA test results indicated that the risk of surface water influence is low and suggested that the sources should be exempt from surface water treatment requirements.

Sodium has been frequently detected in groundwater from the Pond Road wells at levels exceeding the Office of Research and Standards Guideline (ORSG) for sodium (20 parts per million, or PPM). During 2001 and 2002, sodium levels of close to three times the ORSG were measured. According to HWD, the wells have historically had increases in sodium levels in the winter-spring. Levels that exceed the ORSG may be of concern to physicians and sodium-sensitive individuals.

A town-wide study of sodium levels in groundwater (Arnold, October 1, 1980) showed that sodium concentrations at Well #2 had increased from approximately three PPM in 1975 to between 12 and 17 PPM in 1979-1980. The study's author suggested that regular monitoring should be conducted to verify the potential trend observed at Well #2. The levels observed in recent years, when compared to the historical levels, suggest that a long-term rise in sodium levels could be occurring.

Hydrogeologic Settings

The Town's sources extract groundwater from unique hydrogeologic settings, as described below. These settings control both the movement and storage of water and potential contaminants on a local level. The settings are also an important and sometimes limiting factor in the determination of current and future source yields.

- **Bedrock Aquifers:** The wells pump groundwater from fractured bedrock aquifers at maximum depths ranging from approximately 250 feet to 505 feet. The exact orientations and depths of the water-bearing features are unknown. Driller's logs were not available at the time this report was prepared.

The following summary of bedrock geology at the well sites was compiled from a variety of local publications (Zen and others, 1983; Skehan, 2001; Hansen, 1956; Kopera, undated; Mabee, 2005; Robinson, Jr. and Kapo, 2003; Hansen, Brackley and de Lima, 1989; Brackley and Hansen, 1977; Jerden, Jr., 1997).

The Town's sources are located in thick sequences of metamorphosed sedimentary and volcanic rocks that were created over 415 million years ago during the Early Paleozoic Era in areas known as the Nashoba and Merrimack Terranes (see Figure 2 in Appendix A). These terranes are parts of two distinct and separate major New England geologic provinces (the New Hampshire-Maine Sequence and Avalon Province, respectively), and are believed to be the remnants of former micro-continents or island chains that collided with the

ancient North American continent. The resulting belts of rocks together cover roughly the middle third of the state and are on the order of 12 miles thick.

A major fault dipping moderately to steeply to the west has been mapped between Pond Road and Bolton Road, approximately 450 feet northwest of Well #3. This fault, referred to as the Clinton-Newbury Fault, separates the Nashoba and Merrimack Terranes and extends northeastward from Oxford in south-central Massachusetts to Newburyport on the North Shore.

Wells #2 and #5 are located in a portion of the Merrimack Terrane described as unnamed schist (US) and unnamed gneiss (UG). US consists of a dark-gray to dull greenish-gray, partly foliated, partly calcareous chlorite schist, while UG is made up of uneven-grained, moderately foliated gray or greenish-gray (or pinkish to salmon-colored) granite gneiss/migmatite with lenses of US.

Well #3 is located in a portion of the Nashoba Terrane known as the Tadmuck Brook Schist (TBS). TBS in this area consists of a coarse-grained, sulfidic muscovite schist and phyllite with quartzite beds and pegmatite lenses.

The primary minerals associated with the above rock units include:

- **US:** Chlorite (also contains large feldspar crystals)
- **UG:** Feldspar, quartz, chlorite (with minor amounts of muscovite, biotite, apatite and hornblende)
- **TBS:** Muscovite, pyrite, quartz (with some biotite, andalusite and sillimanite; frequent iron oxide staining due to abundant pyrite)

The percentages of the above minerals located in fractured zones vary depending on the specific locations, densities and orientations of those zones. The chemical composition of the minerals and local precipitation determine, in large part, the natural chemistry of groundwater flowing through the fractures.

Due to the significant differences in mineral composition between US/UG and TBS as well as the unique physical and geochemical characteristics of those rock types, the U.S. Geological Survey (USGS) describes US/UG and TBS as separate and distinct “lithochemical” units. This means that the groundwater chemistry at Wells#2/#5 and Well #3 will also be separate and distinct.

According to USGS, US/UG (Wells #2 and #5) should have generally good water quality with low concentrations of dissolved compounds. However, granite gneisses like UG can have naturally elevated concentrations of fluoride, uranium and/or radon. In contrast, groundwater from TBS (Well #3) can have moderate levels of dissolved compounds, including naturally elevated concentrations of iron and sulfate. Local studies (Town of Harvard, 2003) suggest that elevated levels of arsenic may also be found in certain areas of town.

Historical analyses (as reviewed at DEP on June 8, 2006) of groundwater collected from Wells #2 and #5 and a well located near the Pond Road site (USGS Well No. 87) confirm the above interpretations regarding US/UG. Solute concentrations are generally low with the exception of sodium/chloride at Wells #2/#5 which HWD believes is related to road salt impacts. A slightly elevated radon level was observed in a sample from Well #5 in 2001. Radionuclide, IOC

and secondary contaminant test results suggest that fluoride, arsenic and uranium concentrations are relatively low in US/UG.

High levels of naturally-occurring iron and manganese have been historically observed in groundwater from Well #3 (D.L. Maher Co., July 1997) and another bedrock well in the vicinity of Well #3 (USGS Well No. 6). This supports the USGS interpretation of groundwater quality in TBS. No sulfate or arsenic testing results for wells within TBS were reviewed during this study.

Fractures within US/UG and TBS form conduits for groundwater flow, resulting in crystalline bedrock aquifers with low to moderate yields. Yields from two to 10 GPM are common for bedrock wells in this area, and yields of up to 40 GPM have been recorded by USGS. The approved/registered yields for Wells #2, #3 and #5 fall within these reported ranges.

The State Geologist recently mapped at least fourteen fracture sets in the area between Pond Road and Bolton Road. Steeply-dipping fractures trending parallel or sub-parallel to the Clinton-Newbury Fault at approximately 180°, 217° and 240° appear to be the dominant feature in the area near the wells. Similarly-oriented fractures may transmit groundwater to Wells #2, #3 and #5.

The fracture types identified by the State Geologist are described as localized, poorly-parted, short, widely-spaced and/or sporadic. Such fractures are unlikely to transmit large quantities of water. In addition, the 117° and 142° fractures that form “important avenues for vertical recharge” and are common elsewhere in Harvard are conspicuously absent from the area. These limitations may help to explain the low-to-moderate yields observed at the wells.

Faults may sometimes act as groundwater conduits. In this area, however, the Clinton-Newbury Fault is characterized as a ductile (deformed under high temperature or pressure without fracturing), ¼-mile wide band of highly altered rock (primarily TBS and an unnamed quartzite or UQ) containing iron oxide precipitates and sheared areas of compact, pulverized material. In essence, this portion of the fault is currently thought of as a broad collision zone and is not identified as a discrete, water-bearing or “hydrologically significant” feature.

In summary, Wells #2/#5 and #3 share similar yields but are located in two very distinct bedrock aquifers formed by the collisions of two ancient land masses with North America. The aquifers differ in composition and groundwater chemistry, and transmit groundwater through localized fractures separated by a major fault with limited hydraulic capacity.

***Note:** Properly constructed bedrock wells tend to be less prone than shallow drilled/dug wells and springs to the negative water quality effects associated with nearby land uses. This is primarily due to the distance that groundwater must travel in order to reach bedrock wells. However, such wells are not immune to contamination. In this case, the risk of contamination may be enhanced by thin soil deposits over bedrock, the potential for reduced filtering capacity in bedrock fractures and the presence of nearby PSOCs.*

- **Surficial Geology:** USGS (Hansen, 1956) and MassGIS (October 1999) maps show that bedrock surfaces in the vicinity of Wells #2, #3 and #5 are covered

with glacial till. Till is a poorly sorted mixture of boulders, gravel, sand, silt and clay that was deposited directly by glacial ice over 12,000± years ago.

Till deposits do not commonly hold or transmit large quantities of groundwater. The deposits may act as contamination barriers for underlying bedrock aquifers but barrier effectiveness depends on thickness, continuity and coarse material content. Till deposits are very thin or absent near Wells #2/#5 and perhaps up to several tens of feet thick in the vicinity of Well #3 based on its casing depth and nearby USGS well data (Hansen, Brackley and de Lima, 1989).

- **Hydrology & Groundwater Flow:** Surface (storm) runoff near Wells #2, #3 and #5 drains at moderate to steep slopes to the northwest toward Bare Hill Pond (see Figure 1 in Appendix A). A small unnamed and unmapped stream drains portions of Massachusetts Avenue, Bolton Road, Warren Avenue and Pond Road. The stream flows within 150 feet of Wells #2 and #5 en route to the pond.

Bowers Brook exits the north end of the pond and flows to the north toward the Ayer/Harvard boundary, where it joins other tributaries and ponds that ultimately empty into the Nashua River about five miles north-northwest of the wells.

Bare Hill Pond is located approximately 125 to 150 feet northwest of Wells #2 and #5. The north end of the 321± acre pond and its wetlands occupy a significant portion of the SPA for those wells. Several small ponds are located near Well #3, including an old reservoir about 75 feet southwest of that well. The reservoir is maintained as a municipal fire supply source, and storm overflows from the reservoir drain into the unnamed stream described above.

Detailed mapping from DEP (MassGIS, March 2006) shows that freshwater wetlands are scattered throughout the SPAs for the wells. The wetlands mostly include shallow marsh meadows and wooded deciduous swamps. In addition, a deep marsh is located in the portion of the pond nearest to Wells #2 and #5.

The wetlands, ponds and stream described above may serve as important recharge and/or discharge zones for the bedrock aquifer system. In addition, these features may serve a variety of other important hydrologic functions including the filtration of pollutants and reduction of flooding and storm damage.

All of the Town's wells are located outside of 100-year and 500-year flood boundaries as mapped by DEP (MassGIS, July 1997) and the National Flood Insurance Program (Federal Emergency Management Agency, June 15, 1983). Consequently, flooding and associated sanitary issues are not anticipated to represent significant concerns for the wells.

Groundwater under non-pumping conditions may be inferred to flow in the directions of surface runoff (see above) since aquifer gradients tend to mimic topographic gradients in New England. This inference is often useful for assisting with the prioritization of risk associated with PSOCs.

Assumptions regarding groundwater flow directions in bedrock aquifers must be viewed with caution, however, particularly under pumping conditions. Because fracture flow does not always mimic topography and fracture data are unavailable in most cases, land areas contributing flow to bedrock wells are often

difficult to accurately define. SPA delineation procedures partially account for this uncertainty by employing circular protection zones around each well.

- **Ecosystems:** Groundwater, surface water, soil, rock, plants and animals all co-exist and interact with one another in a variety of important and often unknown ways. Local flora and fauna are dependent on healthy water systems and natural habitats, and vice versa. The Town's sources are a part of this cycle.

The sources are situated on or adjacent to enormous blocks of land classified as Critical Supporting Watershed (CSW) for Bare Hill Pond. CSW includes developed and undeveloped land "with the greatest potential to sustain or degrade" key freshwater habitats (MassGIS, November 2003). Less than a third of the state was classified as CSW by NHESP (Division of Fisheries and Wildlife, 2003) under the Living Waters project.

Bare Hill Pond is classified as Core Habitat (MassGIS, June 2002) for terrestrial and partially aquatic wildlife. The pond supports "the most viable habitat for rare species and natural communities." In fact, land along the pond's north shore has been listed as Priority Habitat for State-Protected Rare Species (MassGIS, July 2005) by the Natural Heritage & Endangered Species Program (NHESP).

The abundance of wetlands in the SPAs is a key feature of significant value to local ecosystems. In addition to the hydrologic functions described above, wetlands serve as important wildlife habitats that provide food, shelter, breeding areas and migration corridors for terrestrial and aquatic animals.

Vernal pools are one important type of wetland, and a critical habitat component for certain amphibians and organisms such as fairy shrimp. At least four Potential Vernal Pools and one Certified Vernal Pool have been identified in the SPAs (MassGIS, December 2000; MassGIS July 2003).

- **Other Public Water Suppliers:** No other PWSs are located in the SPAs. However, four public water supply wells associated with Camp Green Eyrie (CGE; PWS ID# 2125006) are located along Bowers Brook less than ¼-mile northwest of the SPA boundary for Wells #2 and #5, as shown in Appendix A.

Many other PWSs withdraw drinking water from surficial and bedrock aquifers within and around Harvard. Approximately 23 other public water supply wells are located in Harvard and a dozen more are located outside of Town boundaries but have SPAs lying partially within Harvard.

Source Protection Areas

SPAs represent the recharge areas that supply water to PWSs. Recharge areas include the surface and subsurface zones from or through which contaminants are reasonably likely to reach a water system source. The recharge area for a groundwater source is defined by the nature of subsurface flow as well as effects induced by pumping.

Within SPAs, land uses and/or naturally-occurring materials may cause a PWS to be vulnerable to contamination. While the sources and extent of naturally-occurring

contaminants may be difficult or impossible to control, land uses that threaten water quality (or quantity) can often be managed to reduce potential adverse impacts. Once SPAs are delineated, land uses can be inventoried within the SPAs and managed by activities outlined in an SPP. This section of the SPP describes how the SPAs for the Town’s wells were determined.

In Massachusetts, DEP has delineated SPAs for all existing non-emergency PWSs. An SPA for an active groundwater source is typically divided into Zone I and the Interim Wellhead Protection Area (IWPA):

- **Zone I:** The immediate land area around a well. It is defined as a 400-foot radius for well yields >100,000 gallons/day (GPD) and a 100- to 400-foot radius for well yields <100,000 GPD, depending upon the pumping rate. Zone I must be owned or controlled by the water supplier, due to its critical role in source protection.
- **IWPA:** The land area over an aquifer that is assumed to contribute water to a well. The IWPA is used as the protection area in the absence of a Zone II (recharge area determined by hydrogeologic study) delineation. For well yields >100,000 GPD, the IWPA is a ½-mile radius. For well yields <100,000 GPD, the IWPA radius is determined from the pumping rate and ranges from 400 feet to a ½-mile. The IWPA includes Zone I.

The DEP-approved pumping rates used to determine the Zone I and IWPA radii for Wells #2 and #5 are 43,000 GPD (30 GPM) and 23,000 GPD (16 GPM), respectively. The resulting Zone I and IWPA radii are:

<u>Source</u>	<u>Zone I Radius (feet)</u>	<u>IWPA Radius (feet)</u>
Well #2	345	1,360
Well #5	304	924

DEP has not delineated an SPA for Well #3 because it is an emergency source. For the purposes of this SPP, an estimated IWPA for Well #3 has been calculated using its maximum pump capacity of 36,000 GPD or 25 GPM (Well #3 does not have an approved pumping rate). The estimated (maximum) IWPA radius is 1,200 feet. No Zone I has been calculated for Well #3 since designation of Zone I would imply compliance requirements.

The IWPA’s for Wells #2 and #5 and the estimated IWPA for Well #3 form overlapping circular protection areas as shown in Appendix A. For the purposes of this report, the IWPA’s and estimated IWPA are collectively referred to as the SPAs.

Land uses within the SPAs are summarized in Appendix A (Figures 3 and 4) based on interpretations of 1999 color infrared aerial photos by the University of Massachusetts (MassGIS, January 2002) and DEP wetland mapping (MassGIS, March 2006). A list of all land uses in these areas is provided in Appendix B.

In summary, most land within the SPAs is used for residences (including a large field/pasture mapped on the Dillard property off of Bolton Road in the SPA for Well #3) or is

covered with forests or wetlands. In addition, Harvard Elementary School, The Bromfield School and the new public library occupy the northeastern quadrant of the SPA for Wells #2 and #5. Harvard Custom Woodworking is located in that SPA just south of the schools, as are the professional offices of two dentists and Alpha Associates. The Town Beach is also located in that SPA, at the west end of Pond Road.

A summary of local zoning classifications and Zone I ownership/control status is provided below:

- **Zoning Classifications:** According to local zoning bylaws (Town of Harvard, April 2, 2005), properties within the SPAs are classified as part of a rural residential and agricultural district (“AR”). Uses allowed by right or special permit in the AR District include single/multiple residences, subdivisions, agriculture, earthmoving, institutional facilities and golf courses.
- **Zone I Ownership/Control:** As depicted on the property boundary map in Appendix A (Figure 5), the Town retains partial control over land use activities within Zone I for Wells #2 and #5, with approximately 85% ownership. Small portions of five private residential parcels are located along the eastern Zone I boundary for those wells. Land that is not owned or controlled (through easements, etc.) by the water supplier is prohibited from Zone I by DEP. The Town is in non-conformance with this requirement at Wells #2 and #5.

In addition, land uses under the Town’s control that are non-essential to the provision of drinking water are prohibited in Zone I areas, according to DEP. The Town is in non-conformance with this requirement at Wells #2/#5 due to the presence of sections of Pond Road, Whitman Road and an athletic field associated with The Bromfield School.

4.0 Water Supply Protection Issues

This section of the SPP describes current and future PSOCs in the SPAs, the methods used to identify those PSOCs and the susceptibility of these water sources to pollution potentially resulting from the PSOCs. This section also includes descriptions of local regulatory controls and the results of the Town’s most recent sanitary survey. Recommendations on specific protection measures addressing these water supply protection issues are listed in Section 5.0.

Potential Contamination Source Identification

In order to assess vulnerability to contamination within the SPAs, a detailed inventory of land uses with the potential to negatively impact water quality was performed. The inventory included a windshield survey; an onsite visit and SPA inspection in October 2005; a file review at DEP’s Worcester office on June 8, 2006; and conversations with HWD and other municipal representatives. The results of the inventory are tabulated and mapped in Appendices A and B and supplemented by a series of database reviews completed by MassRWA as discussed below.

Heating oil storage is a common PSOC. Heating fuel types in the SPAs were assessed by reviewing the local assessment databases in addition to the activities listed above. Based on that review, over 75% of the developed parcels in the SPAs contain heating oil storage. The threats associated with this PSOC are described as part of the Pollution Susceptibility Assessment below.

With the exception of the Town schools and new public library, all developed parcels in or near the SPAs use septic systems for sanitary waste disposal. Septic systems are commonly identified as PSOCs, as depicted in Appendix B and described in detail later in this section. Sanitary sewage from the schools and library is conveyed out of the SPAs to a municipal wastewater treatment plant (WWTP) on Massachusetts Avenue. Treated WWTP effluent (up to 23,000 GPD) is discharged to the ground under DEP Permit #GW-723.

In conjunction with the local land use inventory, an on-line review of DEP-regulated site databases (MassGIS, Various dates; DEP, June 5, 2006) was completed. The review included a search for solid waste facilities; electrical transmission lines and substations; railroads; registered underground storage tanks (USTs); facilities generating, storing, treating, recycling or disposing of hazardous wastes; tier-classified Chapter 21E sites; reported oil or hazardous material releases; large quantity toxic users; ground water discharge permits and polluted surface waters located in the SPAs.

During the DEP database review, three accidents or leaks resulting in fuel releases in the SPAs within the last ten years were identified. The releases are listed below by their Release Tracking Numbers (RTNs):

- **RTN #2-12014:** 5 Pond Road, gasoline/diesel fuel, unknown qty. (1997)
- **RTN #2-13982:** 58 Bolton Road, #2 Fuel Oil, ~110 gallons (2001)
- **RTN #2-14839:** 14 Massachusetts Ave., #2 Fuel Oil, ~1,000 gallons (2003)

According to DEP, Response Action Outcome (RAO) statements were eventually filed for the 1997 and 2001 incidents. The RAOs indicate that remedial work was completed and (a) a level of No Significant Risk was achieved or (b) all Substantial Hazards have been eliminated. Therefore, those two releases do not appear to represent a threat to the wells and are not classified as PSOCs.

The third incident occurred due to a generator pump failure in the boiler room of the Bromfield School (Cushing, Jammallo & Wheeler, Inc., June 2, 2006). The generator is connected to a 10,000-gallon underground storage tank (UST) system installed in the 1980's. The pump supplying fuel to the generator from the UST released about 1,000 gallons of oil to the boiler room floor, floor trenches/drains, soil and groundwater. Remedial activities, including soil excavation and vapor/liquid extraction, resulted in the removal of 65 cubic yards of contaminated soil, 473 gallons of oily liquids, 1,000 pounds of oily solids and 117,271 gallons of groundwater.

Contaminated groundwater was treated to applicable standards and allowed to re-infiltrate the site. Soil and groundwater remediation activities appear to have significantly reduced residual contamination levels. According to the Town's consultant, a level of No

Significant Risk of harm to human health, safety, welfare and the environment has been achieved. No further remediation is planned and an RAO statement has been filed.

The above information suggests that the oil release at The Bromfield School has been successfully remediated by the Town. Consequently, this release is not listed as a PSOC.

In the DEP databases, Bare Hill Pond was listed as “impaired for one or more designated uses” under Section 303(d) of the Clean Water Act. The impairment results from two classes of pollutants (metals and noxious aquatic plants) and one non-pollutant (exotic species) identified during a 1998 assessment of the Nashua River basin (MassGIS, January 2005; DEP, January 2001). Federal law requires DEP to determine the pollutant sources and develop a pollution management, or Total Maximum Daily Load (TMDL), plan for the pond.

A TMDL study (DEP, July 1999) was completed for noxious aquatic plants, suggesting that the cause of that impairment is nutrient (phosphorous/nitrogen) enrichment from both natural (pastures/fields flooded after an 1838 pond expansion) and man-made (land uses around the pond, including septic systems) sources. No TMDL study has been completed for the other major pollutant (mercury in fish) but the state has issued a restrictive fish consumption advisory based on the 1998 assessment results.

The impairment of the pond is suggestive of land use practices and historical decisions unfavorable to the maintenance of good water quality. Depending on the level of interaction between the pond and the bedrock aquifers, the presence of contaminants in surface water could represent potential concerns for groundwater quality at the wells. However, the specific presence of noxious aquatic plants and mercury-contaminated fish in the pond is not considered a significant concern for the purposes of this study.

An on-line review of EPA-regulated site databases (EPA, June 5, 2006) was completed to complement the DEP database evaluation. The review included a search of Envirofacts databases including: Biennial Reporting System (BRS), Comprehensive Environmental Response, Compensation & Liability Information System (CERCLIS), Facility Registry System (FRS), Permit Compliance System (PCS), Resource Conservation and Recovery Act Information (RCRA Info) and Toxics Release Inventory (TRI).

No facilities that handle or release hazardous materials/wastes or toxics were identified in the SPAs as a result of the EPA database search.

The final database review completed for this study was conducted online at the MA Department of Fire Services (DFS) UST Program web site on June 21, 2006. No facilities within the SPAs have or had registered USTs according to DFS. Registered USTs do not generally include tanks storing heating oil for onsite consumptive use.

Following the land use inventory and database reviews, all PSOCs were grouped according to common land use features and assigned unique identification numbers. The locations of numbered PSOCs within the SPAs are shown on Figure 3 in Appendix B. Detailed descriptions of all PSOC groupings and threats are provided below.

Pollution Susceptibility Assessment

In conjunction with the detailed PSOC inventory described above, the potential threat to water quality posed by each PSOC in the SPAs was assessed and ranked. Threat rankings (High, Moderate or Low) were determined in general accordance with the guidelines provided in the *Massachusetts Source Water Assessment Program Strategy* (DEP, August 1999) and the *SWAP Strategy Addendum* (DEP, July 2, 2001), modified as needed based on field observations. Those guidelines are based on data which suggest that land use is the primary cause of many contamination incidents.

The PSOCs and their threat rankings are:

- **PSOC #1: Parking Areas & Roads** – As shown in Appendix A, parking areas and roads are located throughout the SPAs. Roads and/or parking areas are maintained by the Massachusetts Highway Department (MassHighway) at Route 111 (Massachusetts Avenue); the Town at Bolton Road, Pond Road, Warren Avenue, Whitman Road and the schools; and local residents (driveways). Portions of Pond/Whitman Roads are located within Zone Is for Wells #2 and #5.

Threats posed by the parking areas/roads include leaks/spills of motor fluids or hazardous materials/wastes, as well as the application of deicing mixtures. Chemicals associated with these activities can make their way into the subsurface and eventually into groundwater. The chemicals associated with this threat include sodium, chloride, metals, SOCs, VOCs, semi-VOCs (SVOCs) and unknown hazardous materials/wastes.

Storm water runoff could potentially exacerbate this threat by channeling contaminants into localized groundwater recharge areas or flushing soil contaminants directly into the aquifers. The locations and numbers of storm water drains in the SPAs were not assessed during this study.

According to DEP (May 17, 2006), nine roadway accidents resulting in releases of hydraulic oil, diesel fuel, motor oil, ferric sulfate and sulfuric acid have occurred elsewhere in Harvard during the 1994-2005 period. Additionally, while methyl tertiary-butyl ether (MTBE) is not currently a significant concern for HWD, traces of MTBE have been detected in other local PWSs. MTBE is a common component of motor fuel (gasoline) and other petroleum products.

Road salt contamination is often detected in this part of New England (Flanagan, Nielson, Robinson and Coles, 1998), sometimes resulting in the abandonment of private or public wells. Very high concentrations of sodium and chloride have been reported in a Town Highway Department well (Town of Harvard, 2003), and salt levels exceeding the applicable ORSG are common at Wells #2 and #5.

Overall, the threat ranking for this PSOC is **Moderate-High**. The threat is particularly significant on the roads inside Zone Is or draining to Zone Is. Transport of hazardous materials/waste may also be a concern, especially along well-traveled local roads in the SPAs, such as Route 111 and Bolton Road.

- **PSOC #2: Lawns & Fields** – Small- to moderate-sized lawns/fields associated with residential uses are located throughout the SPAs, including a large field at 40 Bolton Road near Well #3 classified as crop land. In addition, large fields associated with the schools and partially used for athletics are located in the SPAs, including one field which extends into the Zone Is for Wells #2 and #5.

Common threats posed by lawn/field use include contaminant releases associated with the application of pesticides or fertilizers and manure, as well as accidental spills of motor fluids from mowers/tractors. Chemicals associated with these releases/spills can make their way into the subsurface and eventually into groundwater. These chemicals include nitrates, SOCs, VOCs, SVOCs and IOCs/metals. Microbial contaminants may also be a concern. Nutrients (nitrogen/phosphorous) associated with this PSOC are common culprits in the degradation of groundwater and surface water quality.

The threat ranking for this PSOC is **Moderate**. The threat is particularly significant at the athletic field in the Zone Is for Wells #2 and #5 due to the size and proximity of the field as well as the potential for intensive turf management. However, the school's policy is to avoid the use of pesticides (Town of Harvard, November 16, 2005). While this represents an excellent management technique, the threat still exists in the event of a personnel or policy change at the facility.

- **PSOC #3: Sanitary Waste** – Water quality impacts due to septic systems are a common concern in this part of New England (Flanagan, Nielson, Robinson and Coles, 1998; Masterson and Portnoy, June 2005). Septic systems are a known cause of groundwater pollution, resulting in widespread and well-documented increases in dissolved nitrate levels elsewhere in the state (NPS, 1999; LeBlanc, Guswa, Frimpter and Londquist, 1986; CCC, Summer 1998).

Threats posed by sanitary waste disposal include septic system failures, poor system maintenance and hazardous material/waste disposal via those systems. In those scenarios, untreated contaminants can make their way into groundwater or find more direct preferential pathways into subsurface water system components. Contaminants associated with sanitary waste disposal may include any chemicals placed into the septic systems as well as nutrients (nitrogen/phosphorous) and microbes such as E.coli. Nutrients associated with this PSOC are common culprits in the degradation of groundwater and surface water quality.

Developed parcels in the SPAs all use septic systems for sanitary waste disposal except for the schools and new public library. One system (19 Pond Road) is located inside the Zone Is for Wells #2 and #5. According to HWD, the system that services the Town Beach on Pond Road has failed and needs to be replaced.

Sanitary sewers for the schools/library discharge to groundwater at the WWTP just outside of the SPA for Well #3. WWTP effluent is treated prior to discharge by an advanced, modular treatment system with nitrate removal equipment. The Town is currently evaluating the possibility of expanding sewer service throughout the village of Harvard Center (including Pond Road properties) to reduce the possibility of groundwater contamination, meet future wastewater demands and reduce excess treatment capacity at the WWTP.

No releases of hazardous or toxic substances are documented for the WWTP. The likelihood of wastewater effluent from the WWTP impacting the wells at levels of concern seems low given the distance involved and the advanced treatment applied prior to effluent discharge.

Despite the enhanced groundwater protection provided by the WWTP, the threat ranking for this PSOC is **Moderate-High**. The threat of groundwater contamination by septic systems is greatest at residential properties inside or near the Zone Is, and within several hundred feet of Well #3. This includes properties along sections of Pond Road, Whitman Road and Bolton Road. The failed system at the Town Beach is also a key concern.

- **PSOC #4: Hazardous Materials & Waste** – Hazardous/toxic materials are commonly stored, used and disposed of by landowners of all kinds. Small or very small quantities of hazardous chemicals and waste are quite likely used or generated by most facilities, businesses and residents within the SPAs including:
 - **Town facilities** – The Bromfield School, Harvard Elementary School and the new public library
 - **Businesses** – Harvard Custom Woodworking, Alpha Associates and the dental offices of John H. Walker and James J. Hammond, Jr.
 - **Private homes** – All homes within the SPAs

Wastes from dental offices may include amalgam and cements from dental procedures as well as X-ray fixer cleaners/fixers/developers. These compounds often contain mercury, silver, chromium and zinc. According to the DEP web site, dental offices contribute an estimated 13 percent of the mercury released to Massachusetts waters, primarily through wastewater discharges.

Woodworking facilities often store and use paints, solvents, wood treatments, stains, varnishes, polishes and adhesives for wood cleaning, wax removal, refinishing, stripping, staining, painting, finishing and brush/spray gun cleaning operations. After use, these compounds may end up as hazardous/toxic waste.

Many everyday products contain such hazardous/toxic materials, including adhesives, art and hobby supplies, automotive fluids, batteries, bleach, cleaners and detergents, lawn/garden products, paints and thinners, fluorescent lights, mercury-containing thermometers and switches, etc. At least seven releases of residential HHW have been reported in Harvard outside of the SPAs between 1995 and 2005 (DEP, May 17, 2006; DEP, June 5, 2006). Releases included petroleum- and solvent-based VOCs and additives as well as beryllium and arsenic. One of these sites is still being cleaned up after ten years of investigations and remedial actions.

Unfortunately, hazardous/toxic products become considered hazardous/toxic waste or “household hazardous waste” (HHW) and a concern for groundwater quality if they are used or no longer needed and then discarded improperly to the ground, storm sewers or septic systems. A wide variety of chemicals associated with such materials may be potentially released to the ground, including: VOCs,

SVOCs, SOCs, IOCs/metals (including arsenic and mercury), acids, surfactants, nitrogen/phosphorous and polychlorinated biphenyls (PCBs).

Despite the presumed small volumes of hazardous/toxic products in the SPAs, their presence or potential presence is still a concern for the wells. The overall threat ranking for this PSOC is **Low-Moderate**.

- **PSOC #5: Electrical Distribution Equipment** – Electrical transformers and distribution lines are located along roads inside of the SPAs. During our site visit, a pad-mounted transformer was observed at The Bromfield School and pole-mounted transformers were observed inside the Zone Is for Wells #2/#5.

Threats posed by transformers include leaks/spills of transformer oil or mineral oil dielectric fluid (MODF). Several transformer spills have been documented by DEP in the Harvard area (DEP, May 17, 2006). The released oil/MODF can make its way into the subsurface and eventually into groundwater. These chemicals may include VOCs, SVOCs, metals and PCBs.

No staining below the transformers indicative of oil releases was observed during our site visit. However, the presence of transformers inside Zone I boundaries is a special concern and the PCB content of internal oils/MODF is unknown. The threat ranking for electrical distribution equipment is **Low-Moderate**.

- **PSOC #6: Petroleum Storage Systems** – Threats posed by petroleum storage/usage include leaks, spills and overfills. Fuel released by these activities can make its way into the subsurface and eventually into groundwater. Chemicals in the fuels may include VOCs, SVOCs and metals.

Water quality impacts due to leaking storage tanks are frequently detected in this part of New England (Flanagan, Nielson, Robinson and Coles, 1998). At least 19 petroleum spills have occurred in Harvard since 1989 (DEP, May 17, 2006), including the three heating oil releases inside the SPAs identified above in the DEP database review summary. Cleanups of home heating oil spills routinely cost MA residents between \$20,000 and \$50,000 each, and costs have exceeded \$300,000 in some cases (DEP, January 2004).

Small to large quantities of heating oil (No. 2 Fuel Oil) are stored at 43 homes, businesses and municipal facilities inside the SPAs, including the 10,000-gallon UST at The Bromfield School. The home at 19 Pond Road inside the Zone Is for Wells #2 and #5 is heated with oil, as are other homes within several hundred feet of those wells and Well #3.

The construction/age/type of the storage tanks at most of these locations is not clear based on available data. However, the Health Department has required UST installation permits for all new USTs since March 1982 and requires fuel storage permits for all USTs. This permit information may assist other Town officials in determining the construction/age/type of USTs within the SPAs.

The Bromfield School UST appears to have aged well beyond the typical life expectancy (15-20 years) of similar tanks based on information provided in the RAO report. The status and condition of that UST's spill/overfill protection and corrosion control systems were not evaluated as part of that document.

Overall, the threat ranking for petroleum storage systems is **Moderate-High**. The small amount of fuel needed to contaminate drinking water; the frequency of accidental fuel releases; the unknown condition of many tanks; and the potential for quick migration in the subsurface suggest that this PSOC is a special concern.

- **PSOC #7: Animal Waste** – Animal waste is a potential source of waterborne disease. Animals of concern in this case include mainly pets traveling near the Bolton Road pump house (the nearby reservoir is a popular ice skating spot) and within Zone Is or areas draining directly into Zone Is.

Pet waste may include nitrogen, phosphorous and microbial contaminants. These pollutants may travel short distances through the subsurface to the wells, or may enter a well via unseen pathways along its casing or exposed bedrock fractures. The threat ranking for this PSOC is **Low**.

- **PSOC #8: Forestry** – Forested parcels up to approximately 30 acres in size are located in the SPAs, including a number of vacant Town-owned parcels. While no evidence of recent logging was observed during our site visit, logging operations may periodically be completed in the SPAs.

According to DEP (August 1999), unregulated logging operations or operations completed without conformance to the Massachusetts' *Forest Cutting Practices Act* (FCPA) “can damage the forest floor and compact forest soils, significantly reducing their porosity and infiltration rate...non-point source pollution that may be released during forestry operations includes fuel, oil and coolants used in equipment for harvesting and road- building activities. Pesticides are rarely used in Massachusetts forestry operations but, if used, may be toxic to human health and the environment, if not handled, applied, and stored properly.”

The threat ranking for this PSOC is **Low** for the wells. Chemicals that may be associated with this PSOC include SOCs, VOCs, SVOCs and IOCs/metals. Nutrients (nitrogen/phosphorous) associated with this PSOC are also common culprits in the degradation of surface water quality.

- **PSOC #9: Pond Weed Management** – Herbicides were sporadically applied to Bare Hill Pond until 1983, and are still periodically considered as a partial solution for weed control in addition to dredging, draw-downs and harvesting (Town of Harvard, 2003). Public requests to apply herbicides were voiced in 1987, 1999 and 2002.

Chemicals associated with herbicide applications can make their way into the subsurface and potentially into groundwater. These chemicals may include nitrogen, phosphorous, SOCs, VOCs, SVOCs, metals and unknown proprietary compounds. DEP permits are required to apply herbicides to surface water bodies, and DEP often won't allow applications in Zone Is.

Despite the MPA results described in Section 3.0, the pond may possess some limited degree of hydraulic connection to the bedrock aquifer near Wells #2 and #5. Consequently, long-lived or persistent contaminants such as some herbicides may still represent a threat to the wells.

The threat ranking for this PSOC is **Low** primarily because herbicide contamination has not yet been detected at the wells and herbicides have not been routinely applied since 1983. While this is an excellent situation from a groundwater perspective, the threat still exists due to the proximity of the wells to the pond and the uncertainty over future weed management techniques.

Future Land Uses & New Water Supplies

In addition to the detailed PSOC evaluation provided above, the potential threats to water quality and quantity posed by future land uses in the SPAs were assessed.

As discussed in Section 3.0, the SPAs are zoned for residential-agricultural use and many parcels are already being used for residential or municipal (educational, recreational and water supply) purposes (see Figures 3 and 4 in Appendix A, and the landowner list in Appendix D). For the most part, land uses in currently developed areas of the SPAs are unlikely to change significantly in the immediate future.

The state (Executive Office of Environmental Affairs, Spring 2001) recently identified the land remaining to be developed in the SPAs through a detailed land use analysis that considered the constraints posed by local zoning laws, topography and other factors. The results of their analysis (see Map 3 for the Town of Harvard at <http://commpres.env.state.ma.us/content/buildout.asp>) suggest that approximately 50% of the land within the SPAs is not permanently or even partially protected from development.

Consequently, despite the apparently stable nature of development within the SPAs as described above, future land uses may constitute a significant concern for the Town. The biggest future land use threats in the SPAs can be broken down into three categories, listed in approximate order of priority below:

- Large, privately-owned, partly developed but subdivide-able parcels – A full review of local zoning bylaws and assessor’s maps to identify all subdivide-able parcels was beyond the scope of this study. However, a preliminary review of the assessor’s maps suggests that some of the residential properties in the SPAs may be large enough to consider future subdivision. This subset of properties potentially includes a 31-acre parcel at 72 Massachusetts Avenue (No. 22-21), located adjacent to the large Town-owned parcel containing Well #3.
- Small, vacant, privately-owned developable parcels – Three small lots (Nos. 22-39, 22B-28 and 22B-37) fall into this category. These parcels are located between Bolton Road and Warren Avenue about halfway between Well #3 and Well #2/#5. The small parcel sizes suggest that limited development could occur so these lots are assumed to represent a lower priority threat.
- Vacant Town-owned parcels – The Town owns twelve vacant lots in the SPAs (in addition to the Town Beach and the two well sites). These are considered the lowest priority future land use threat as the Town controls their disposition and should be able to restrict their development. Four of these lots are considered non-developable due to their size, location (large wetland at north end of the pond) or landlocked-nature. The remaining parcels include two adjacent to the

well sites (Nos. 22A-15 and 22-26) and six set aside for the park department at the west end of Pond Road (between Wells #2/#5 and the Town Beach).

Of particular concern are any remaining large subdivide-able parcels in the SPAs, as described above. Assuming similar land uses throughout the SPAs, larger parcels will have greater potential impacts on water quality due to their size.

Four vacant lots (Nos. 17-3.2.2, 22-60.1, 22A-34.1 and 22B-25) are currently protected under the ownership of the Harvard Conservation Trust (HCT), a private non-profit organization that seeks to preserve the Town's unique character and valuable (including water) resources. No developments are currently planned on those parcels owned by HCT. While the Trust's primary mission is to protect open space and prevent unwanted development, it will support selective residential developments and has considered an affordable housing project on Parcel No. 22A-34.1 ("the Barba land") across the pond from the wells. HCT also supports the Town's exploration for an additional source of drinking water on Parcel No. 17-3.2.2 (HCT, personal communication, June 24, 2006).

The creation of new land uses on any of the developable parcels in the SPAs or changes in land use on currently developed properties, however unlikely, may pose additional threats to the Town's water sources. Land uses allowed by right or Special Permit in the SPAs include single/multiple residences, subdivisions, agriculture, earthmoving, institutional (educational, religious, municipal, public service corporation, social/recreation club, charitable organization and cemetery) facilities and golf courses. Each of these types of use may be associated with potential contaminant sources.

In addition to the chemical threats posed by certain land uses, the increase in impervious surface area caused by site development can potentially lead to reduced groundwater recharge, lower well yields, higher flood flows, less late summer runoff, increased erosion and/or sediment/pollutant transport. The future installation of new water supplies to service developed or developing areas also raises the possibility of well interference, which could result in lower well yields for the Town depending on the number and location of the new supplies and their associated water demands.

The installation of new water supplies to service developed or developing areas within the SPAs does not appear to be a significant threat to the Town's wells given the current patterns of land use in the SPAs and the prohibition on large commercial water users. However, the agricultural, institutional and golf course uses allowed in the SPAs could potentially require large amounts of water, as could a large subdivision.

Finding additional sources of drinking water for public supply purposes is becoming increasingly difficult. The Massachusetts Water Resources Commission (WRC) has completed an evaluation of the water budget "stress level" in the Nashua River basin, in which both wells are located. Stress was determined by estimating the net outflow of water from the basin based on PWS withdrawals, wastewater treatment plant returns and septic returns. The Nashua River basin was classified as moderately stressed as a result of that analysis, meaning that the net outflow equals or exceeds the summertime low flow in the river (WRC, December 13, 2001).

The Town is currently attempting to locate an additional source of drinking water as recommended in the *Harvard Town Center Action Plan* (TCAP; Bluestone Planning Group, March 2005). The TCAP notes that the current system relies on the storage tank to compensate for peak demands and emergency flows, and that additional source capacity may be needed to meet those demands as well as future demands posed by village growth. The Town is preparing to test a potential supply well located in the SPA for Wells #2/#5, about 1,000 feet north-northwest of those wells. Another possibility under consideration is the routine activation of Well #3.

Both of the potential supply sites have struggled with water quality issues in the past. The current test well was installed in 1996 and abandoned after initial testing suggested that radionuclide levels may be unacceptable. Well #3 has a history of high dissolved iron and manganese levels. The Town is hoping to avoid the need to install a treatment facility for Well #3 or locate a brand new source by re-evaluating the 1996 test well. The test well has an estimated yield of approximately 32 GPM based on the results of a 48-hour pumping test (D.L. Maher Co., July 1997). An extended (several weeks long) pumping test is planned for the test well later this summer.

Local Regulatory Controls & Plans

Local regulatory controls that protect or impact water resources on privately-owned or Town-owned parcels in the SPAs are codified in the *Code of the Town of Harvard, Massachusetts* (Town of Harvard, November 30, 2005), including:

- Chapter 115, Water (General Bylaw)
- Chapter 119, Wetlands Protection (General Bylaw)
- Chapter 125, Protective Bylaw
- Chapter 130, Subdivision Control (Regulations)
- Chapter 145, Board of Health (Regulations)
- Chapter 147, Wetland Protection Bylaw Rules

The Wetlands Protection bylaw was revised on February 23, 2006 and has not yet been incorporated into the general code. A Water Supply Conservation bylaw was adopted on March 27, 2006 and will eventually be incorporated as Chapter 117 of the general code.

The Town of Harvard's above-referenced regulatory protections are intended, among other things, to:

- Protect the community from the detrimental effects of unsuitable development;
- Protect persons and property against the hazards of inundation and pollution;
- Prevent pollution or contamination of, ... conserve and ... protect watercourses and their adjoining lands, and the groundwater table on which the inhabitants depend for their water supply;
- Provide for compatibility with individual water supply and sewage disposal systems and their renewal, and with public systems which may become available; and

- Conserve health, natural conditions and open spaces.

Local bylaws/regulations address **groundwater supply protection** (supplemental design standards for wastewater systems serving more than four private structures or carrying flows over 2,000 GPD), **underground storage tank installation/maintenance, well construction/testing/abandonment, sewage and other potential sources of contamination** (focusing on setbacks for contaminant/sewage storage/disposal and prohibiting private communal wastewater systems). In addition, the new **water supply conservation** bylaw authorizes the Town to restrict outdoor watering, filling of swimming pools and use of automatic sprinklers in the event of a water shortage.

Furthermore, the Town's bylaws/regulations require a **site plan review** process for most new development and re-development, demonstrating that proposed site designs provide for a minimum of environmental protection and allowing the Town to request changes to proposed development plans if they don't meet local requirements for waste disposal, drainage, water pollution, etc. This could be beneficial to the Town if the plans apply to properties inside the SPAs.

To encourage water resource and wetland preservation, the Town provides "Flexible Plan Subdivision" and "Open Space and Conservation Planned Residential Development" options for developers. Also, the Town's Protective Bylaw appears to partially encourage **low-impact development** (LID) practices via the site plan review and special permit authorization standards. LID methods minimize water resource impacts via on-site infiltration of storm water and other techniques. Harvard requires builders/developers to retain runoff on-site or discharge it to a watercourse without material impact on abutting properties. Additionally, the Town requires that storm water be managed in accordance with state-of-the-art techniques promoted by DEP.

No local health regulations prohibiting the use of commercial **floor drains** appear to have been adopted by the Town. Improperly installed, maintained or abandoned floor drains represent potential conduits for groundwater contamination. No commercially-zoned areas are located in the SPAs but institutional (including municipal/educational) uses with the potential for oil/chemical storage and floor drain installation are allowed in the SPAs.

The Town has incorporated **earthmoving** limitations into its Protective Bylaw, but does not appear to specify a minimum depth to the water table as part of those limitations. Excavation too close to the water table can increase the risk of groundwater pollution.

No aquifer or water resource protection districts have been designated by the Town to prevent contamination and protect recharge areas for current and future drinking water supplies. DEP strongly encourages all towns with PWSs to adopt such bylaws. Many towns also elect to protect private water supplies through these actions.

Local planning efforts, while non-regulatory in nature, supplement the above-referenced bylaws and provide guidance to local boards in charting the future course of land use growth and regulation in the Town. Key planning documents that may impact water resources and land uses in and around the SPAs include the *Master Plan* (MP; Community

Opportunities Group, Inc., November 2002), *Open Space and Recreation Plan* (OSRP; Town of Harvard, 2003) and *Harvard Town Center Action Plan* (TCAP; Bluestone Planning Group, March 2005).

The OSRP aims, in part, to protect groundwater and wetland resources; preserve land for conservation and natural purposes; address open space needs and educate the public on natural resources and non-polluting land and water practices. The five-year implementation steps recommended in the OSRP include:

- Aggressive enforcement of wetlands laws;
- Creation of a Bare Hill Pond Watershed Management Plan and Overlay District;
- Evaluation of minimum lot size increases;
- Creation of a prioritized list of parcels targeted for conservation;
- Collaboration and investment for the purposes of land protection;
- Mapping of the Town's storm drainage system;
- Development of a brochure outlining pollution-safe practices; and
- Public education on non-point source pollution.

The MP is intended, in part, to protect groundwater, recharge areas and wetlands; ensure a safe and adequate water supply; protect natural assets such as Bare Hill Pond and control environmental pollution. The MP action items include:

- Maintaining an up-to-date OSRP;
- Annual appropriations for land conservation;
- Creation of a Groundwater Protection Overlay District;
- Clarification of the Wetlands Protection and Floodplain Overlay Districts;
- Installation of a municipal geographic information system (GIS);
- Completion of a village public realm plan/wastewater disposal options study; and
- Establishment of a Bare Hill Pond Watershed Overlay District.

The TCAP addresses the MP Town Center recommendation and provides a comprehensive view of the growth and preservation challenges facing the historic village of Harvard Center, located along the northeastern SPA boundary for Wells #2 and #5. The future of the water system is tied to future of this village, as the system supplies drinking water to the village and land uses (such as a dense network of septic systems) in the village have the potential to adversely impact groundwater quality. The TCAP suggests that the creation of a village wastewater treatment and disposal system would help to diminish septic system impacts and reduce nutrient loading of groundwater.

TCAP recommendations include:

- Developing an additional, non-emergency drinking water source to meet peak demand periods and future demands associated with village growth;

- Creating a municipal water-and-sewer district and commission to coordinate water resource management functions;
- Developing a municipal sewer system for the village that builds off of the existing school system and uses additional leaching fields as needed;
- Amending zoning bylaws to require modern storm drainage technology in the Bare Hill Pond Watershed;
- Working with the state to reduce or eliminate the use of road salt in the Bare Hill Pond watershed; and
- Establishment of a watershed overlay district.

Sanitary Survey Results

Sanitary surveys are used by DEP to enhance the production and delivery of pure and safe water by evaluating a system's source, equipment, facilities, operation, monitoring schedule and maintenance plan. Community systems like this one are periodically surveyed by DEP. EPA's proposed survey frequency goal is every five years.

A sanitary survey was last completed for the Town in April 2005 (DEP, May 20, 2005). Following that survey, DEP required the following actions:

- Submit an *Annual Statistical Report* for 2003;
- Obtain a *secondary operator* and submit a *PWS Staffing Plan*;
- Respond to outstanding *Notices of Noncompliance*;
- Develop a *backflow prevention device* testing/reporting program;
- Develop *Metering* and *Unaccounted-For Water* policies;
- Complete a *leak detection* survey and repair leak(s);
- Install high- and low-level *alarms* for the water storage tank;
- Complete two rounds of *Microscopic Particulate Analyses* for Wells #2 and #5;
- Submit a copy of the most recent *tank inspection* report;
- Install a *locked gate* at the storage tank entrance;
- Repair the storage tank *water level indicator*;
- Install water *meters* on all connections;
- Notify consumers/users/officials annually about *cross-connection controls*;
- Develop an *Operation & Maintenance (O&M)* manual;
- Install emergency *disinfection* tap/port and create standard operating procedures;
- Calibrate *master meters* on an annual basis; and
- Submit a lead-and-copper *sampling plan*.

According to HWD, each of these items has been addressed to DEP's satisfaction or is in the process of being so addressed. DEP also made the following recommendations:

- Investigate possible future *PWS interconnections*;
- Notify DEP if the system is *modified* or *expanded*;
- Adopt protective *bylaws* for wellhead protection;

- Adopt a staff training policy and establish a *training budget*;
- Review *spending levels* in the Master Plan and Capital Improvement Plan;
- Seek professional assistance in preparing and improving *CCRs*;
- Adopt Connections/New Hookups, Cell Tower/Antennae, Delinquent Customer Payments and Turn-on/Turn-off *policies*;
- Develop a plan to report on *infrastructure* assets and depreciation;
- Review the water connection and backflow device testing *fee schedules*;
- Consider adopting an *Enterprise Accounting* program;
- Consider raising water *rates* and more frequent *billing*;
- Adopt a *water use* restriction bylaw/ordinance;
- Develop/adopt/implement *water conservation/drought contingency* measures;
- Maintain a water *complaint tracking* log;
- Evaluate emergency standby/auxiliary *power sources* for the wells; and
- Develop/adopt/implement an *SPP*.

According to HWD, each of these items has also been addressed to DEP's satisfaction or is in the process of being so addressed. Many of the non-financial DEP recommendations are addressed or documented in part via this SPP. The SPP itself fulfills the last DEP recommendation.

5.0 Recommended Protection Measures, Committee & Schedule

This section includes specific recommendations on protection measures designed to manage and reduce the potential risks associated with land uses and PSOCs within the SPAs. It also includes a description of the source protection committee and implementation schedule, as recommended by DEP (November 2001).

Overall, existing land uses within the SPAs represent an important and ongoing threat to the Town's water supplies. Nine specific PSOCs, several with threat rankings of Moderate or higher, were identified during this investigation. Other issues warranting careful attention were also identified, including future land uses, local regulatory controls/plans and sanitary survey recommendations.

Despite the PSOCs and other threats, there are opportunities for the Town to implement voluntary protection measures near the wells and influence land use decision-making at other sites within the SPAs. These opportunities are enhanced by the facts that the Town and HCT already own significant portions of the lands surrounding the wells and currently manage them for conservation purposes. In addition, the Town is already responsible for road, beach, school and library operations and maintenance. Another important and unusual fact is that land owners within the SPAs are for the most part residents of the Town and have a vested interest in safeguarding the future of its resources.

Completion of the measures recommended below would not only further reduce Town liabilities but also markedly improve local water quality and quantity protection.

Protection Measure Recommendations

To protect these drinking water sources, the water supplier should consider implementation of the following protection measures or “best management practices” (BMPs). The recommended measures address both specific PSOCs and other water quality/quantity concerns identified during the preparation of this report. Suggested priorities for action are highlighted later in the report. **Note: All BMPs referenced below are available on the internet at the addresses shown in Section 7.0.*

A. Supplier-Owned Properties – Based on MassRWA’s observations, the Town’s current water operators and commissioners are very interested in protecting drinking water quality and actively seeking to improve protection despite their resource limitations. In addition to requesting this SPP, the Town has actively sought to implement protection measures at their facilities including:

- Regularly *inspecting* the SPAs and maintaining *neat, sanitary* facilities;
- Installing a PWS *sign* and locking *gate/doors* at Pond Road;
- Periodically *cleaning* the water storage tank and assessing *cross-connections*;
- Investigating preventive chlorine *disinfection* options;
- Pursuing additional groundwater *sources*;
- Adding an experienced *manager* and new *operator* to the HWD staff;
- Enlisting experienced *volunteer* assistance with capacity improvement;
- Aggressively pursuing sanitary survey requirements *and* recommendations;
- Investing in a custom *telemetry* system and *main replacement* program; and
- Incorporating potential *security improvements* for the Bolton Road pump house access road into a proposed utility project.

The Town has also proactively promoted other projects designed to improve groundwater protection, such as:

- Conveying *sewage* from the schools/library outside of the SPAs;
- Completing a *wastewater district* feasibility study which includes Pond Road;
- Enhancing nutrient removal thru *innovative* technology at the WWTP;
- Minimizing *road salt* usage;
- Avoiding outdoor *pesticide* use at the schools; and
- Timely, comprehensive *cleanup* of the oil spill at The Bromfield School.

To further improve system protection, the Town (including not only HWD but other Town departments as applicable) should continue to implement and support the above measures while following the general BMPs outlined in *Water Suppliers Protect Drinking Water* (DEP, January 2002). In addition:

1. **PSOC #1 - Parking Areas & Roads:** Monitor school/library parking areas and Town roads in the SPAs, particularly in Zone Is. To the extent possible, do not allow motor vehicles to park near the wells unless needed to service the wellheads. Immediately clean up and properly dispose of any automotive fluid

or hazardous material spills. In the event of such spills, follow the BMPs for *Managing Spills of Oil & Hazardous Materials* (DEP, April 2006).

If not already in place, maintain a supply of materials to clean up small oil and chemical spills (such as absorbent pads/booms and drums) at the Department of Public Works (DPW) garage. As needed, train key personnel on proper spill response procedures.

Notify DPW highway personnel and fire officials that these areas are located in or near SPAs (example notification letter in Appendix E). In particular, state that chemical spills or winter maintenance activities in those areas have the potential to negatively impact water quality at the wells. Assess the Fire Department's level of preparedness for spill incidents.

Educate school/library employees and students/visitors on the importance of protecting the wells from motor fluids. One method of doing this is to post notices in common areas alerting them to notify the operator of any fluid spills on driving surfaces (example posting is provided in Appendix D).

Continuation of parking/traffic in the Zone Is and along Bolton Road seems unavoidable. However, the Town should be aware that a single unreported fuel tank failure could heavily contaminate any of their wells. Such an incident has the potential to not only take the contaminated well out of service for an extended period but also to prevent the installation of a nearby replacement well.

This type of event could be particularly problematic on Pond Road, where well re-location options are very limited and the Town is heavily dependent on the continued operation of those sources. During future planning activities, consider the possibility of removing sections of Pond Road and Whitman Road from service and re-routing traffic outside of the Zone Is. In order to accomplish this, access to residential properties at 19 Pond Road and 13 Whitman Road would need to be re-configured, and a new access to the Town Beach would need to be designed (potentially through Town land at the west end of Whitman Road).

While we appreciate the difficulties/costs associated with this suggestion, such an effort should be considered if the opportunity arises in order to increase well protection and attain compliance with DEP's Zone I land use standards. The costs and aggravation of such a project need to be weighed against the possibility that the Pond Road wells could be permanently damaged at any time.

HWD is concerned about the potential impacts of road runoff in the small stream near the Pond Road wells. The OSRP states that the Nashua River Watershed Association (NRWA; <http://www.nashuariverwatershed.org>) has sponsored or is sponsoring a volunteer water quality monitoring effort in the tributaries to Bare Hill Pond. Contact NRWA to discuss the availability of testing results for the stream near the wells and support their efforts to understand runoff issues. Also, support and review any efforts initiated by the Bare Hill Pond Watershed Management Committee (BHPWMC) to study water quality in the stream/pond.

If not already part of the municipal maintenance program, periodically monitor storm water discharge points in the SPAs. If visual evidence of a potential

pollutant release is observed, take corrective action or recommend further evaluation. Pay particular attention to drains located in or near Zone Is.

In general, encourage the discharge of road drainage away from the wells and outside of the Zone Is. Consider mapping storm water drain systems throughout the SPAs to better understand the potential risks posed by such systems. During future repairs and upgrades, encourage storm water containment and runoff pollution control by using LID BMPs. LID BMP descriptions and case studies are provided by the Massachusetts Executive Office of Environmental Affairs (EOEA) at <http://www.mass.gov/envir/lid/default.htm>.

It is our understanding that DPW currently uses a 4:1 sand-to-salt mixture for winter road maintenance. Encourage DPW to monitor mixture application rates and continue to limit the use of road salt on SPA roads during winter months. Recommend, as warranted, that DPW consider de-icing alternatives (salt substitutes) and employ salt management strategies as outlined in *Syntheses of Best Practices – Road Salt Management* (Transportation Association of Canada, 2003) and *Deicing Salt – Still on the Table* (Keating, May/June 2001). Plow snow away from Zone Is if possible.

2. **PSOC #2: Lawns & Fields:** Immediately clean up and properly dispose of any fluid spills from lawn-mowing or landscaping equipment. Continue to avoid the use of pesticides on Town school properties. Carefully manage, and reduce to the extent possible, the application of fertilizers.

In general, follow organic lawn care BMPs such as those listed in *Healthy Lawns & Landscapes* (Center for Ecological Technology, May 2002) and *Standards for Organic Land Care: Practices for Design and Maintenance of Ecological Landscapes* (Northeast Organic Farming Association, August 2002).

If chemicals must be used, follow the pesticide/fertilizer BMPs at <http://www.mass.gov/agr/pesticides> and <http://www.mass.gov/agr/farmproducts> (Massachusetts Department of Agriculture or DAR, undated) as well as <http://www.state.ma.us/agr/waterwellbeing>.

With regards to the school athletic fields, follow the BMPs outlined in *Turf Management for Municipal Athletic Fields* (Essex Conservation District and Department of Food & Agriculture, undated). Refer to the University of Massachusetts Turf Program (<http://www.umasturf.org> or 413-545-0111) with specific questions related to athletic field management, related training opportunities and soil testing options.

According to the DAR web site, integrated pest management (IPM) plans for the schools require annual updates and were last updated on November 16, 2005. IPM is an approach to pest control that relies on a combination of common sense practices, not just pesticides, for preventing and controlling pests. Continue to update the IPM Plan as needed in accordance with DAR requirements.

3. **PSOC #3 – Sanitary Waste:** Continue to maintain and monitor the innovative WWTP using certified operators, and replace or repair failed components as needed. Keep a complete record of inspections and maintenance activities as

well as system plans. MassRWA is available to provide technical assistance for municipal wastewater system operations if needed.

Continue to explore options to improve WWTP efficiency and provide sewer service in the village and SPAs. Consider including Bolton Road and Warren Avenue in the wastewater system expansion plans. Also, consider the use of watertight sewer manhole covers in SPAs for improved groundwater protection.

Install a modern septic system at the Town Beach in accordance with applicable state and local regulations. Alternatively, continue to consider the possibility of tying the beach facility into the proposed sewer expansion.

Educate school/library/beach staff, students and visitors regarding the possibility that chemicals disposed down sinks, toilets and drains may kill the beneficial bacteria that treat wastewater. These chemicals may eventually show up in private or public drinking water supplies. Instruct staff to apply bleach, disinfectants and drain/toilet bowl cleaners sparingly and in accordance with product labels. Consider posting warning signs (example in Appendix D) at common areas in the schools/library/beach where disposal may occur.

Encourage water conservation and reduce water demand by educating visitors/students/staff and installing low-flow fixtures if needed. Less water use means less demand on the wells. Less demand means more capacity to handle emergencies and future facility use/growth.

4. ***PSOC #4 – Hazardous Materials & Waste:*** Continue to avoid the storage of non-essential hazardous materials at the Bolton Road pump house and Pond Road equipment vault.

At the schools, library and beach, store any essential hazardous materials in secondary containment areas or cabinets with manufacturer's safety data sheets (MSDSs). Periodically review chemical/waste handling and storage practices with staff and assess the condition of any chemical containers and containment areas. As needed, repair damaged items and clearly mark the contents and hazardous nature of each container.

In general, minimize the use of hazardous materials and encourage the use of "green" cleaning alternatives at Town facilities. Encourage the application of DEP's BMP fact sheets for hazardous materials and wastes at <http://www.mass.gov/dep/recycle/compliance/factguid.htm#collection>. Follow the BMPs in *Managing Small Quantity Chemical Use to Prevent Contamination of Drinking Water* (EPA, July 2001) and *A Summary of Requirements for Small Quantity Generators of Hazardous Waste* (DEP, June 2004), as applicable.

Notify staff/visitors/students that improper hazardous material disposal has the potential to degrade drinking water quality. Consider posting warning signs such as the one shown in Appendix D at common areas in Town facilities. Encourage staff/visitors/students to immediately report any waste spills.

Immediately clean up and properly dispose of any oil or chemical spills at the schools, library and/or beach. Maintain a supply of materials to clean up small

spills, such as absorbent pads/booms and drums, at those facilities. Train key personnel as needed on proper spill response procedures.

Inspect Town facilities for floor drains such as the one that contributed to the recent fuel oil contamination incident. If the potential exists for pollutants to enter the ground via floor drains, then either the threat or the drains must be removed. Pay particular attention to any drains which ultimately discharge to the ground from chemical storage, maintenance or boiler room areas.

5. **PSOC #5 – Electrical Distribution Equipment:** Assess the condition and possible fluid PCB-content of transformers along Town roads and on Town properties in the SPAs, especially those located in or near Zone Is or the entrance to the Bolton Road pump house. Coordinate the assessments through a local electrician or the local electric utility (Massachusetts Electric Co. or MECO; 800-322-3223). Notify MECO that some of their transformers are located in the SPAs and if PCBs are present request that non-PCB containing fluids be used. Review MECO’s and the Town’s emergency response procedures in the event of a spill near a wellhead.
6. **PSOC #6 – Petroleum Storage Systems:** Review and implement (as needed) BMPs for the school/library petroleum AST/UST systems including *Managing ASTs to Prevent Contamination of Drinking Water* (EPA, July 2001), *Managing USTs to Prevent Contamination of Drinking Water* (EPA, July 2001) and *Tips for Maintaining Your Home Heating System: Preventing Heating Oil Leaks and Spills* (DEP, May 2004). BMPs for heating oil spill prevention are also provided by DEP at <http://www.mass.gov/dep/cleanup/homeownr.htm>.

Inspect/maintain and document the condition of all fuel system components at the schools/library on a regular basis. Monitor for evidence of leakage or spills. Contact school/library officials and oil suppliers as needed to assess coverage in the event of a spill. If not already completed, review delivery procedures with the oil supplier(s) and request prompt notification even for small spills. Delivery accidents are the cause of many petroleum releases.

The fuel storage UST at The Bromfield School is a special concern due to its age and unknown condition. If not already completed, budget for the testing and/or replacement of this tank and complete the work as soon as possible. Consider removing all fuel storage USTs at the schools/library and replacing them with modern ASTs or, even better, switching to alternative groundwater-friendly fuels such as propane or natural gas. If heating oil is chosen, the new ASTs should be placed outside of the SPAs if possible with full secondary containment, leak/spill/overflow protection and roofed enclosures (if outdoors).

7. **PSOC #8 - Forestry:** If forest management is anticipated, follow the recommendations and requirements outlined in the *Massachusetts Forestry Best Management Practices Manual* (Kittredge, Jr., and Parker, January 2000) and the FCPA, as appropriate. According to DEP (August 1999), “selection of appropriate machinery, forestry practices, and access road construction and maintenance techniques can mitigate potential threats to water quality.” DEP

considers forestry operations that follow FCPA plans as a Low threat to public drinking water sources.

8. **PSOC #9 – Pond Weed Management:** Discourage the application of herbicides to Bare Hill Pond, particularly in the Zone Is. Support efforts to manage weed growth through non-chemical methods as described in the OSRP/TCAP. If a watershed or aquifer overlay district is created as recommended in the MP and OSRP, consider incorporating herbicide application restrictions or conditions (such as groundwater monitoring) as warranted to protect Wells #2 and #5.

Share the location of the SPAs with new members of the Harvard Conservation Commission (HCC) and BHPWMC as needed, and notify them in writing that herbicide applications have the potential to negatively impact water quality at the Pond Road wells (in addition to other private wells around the pond). Example notification letters are included in Appendix E.

If chemicals must be used, encourage officials to follow the policies and BMPs published by the Massachusetts Department of Conservation and Recreation (DCR), including the *Eutrophication and Aquatic Plant Management in Massachusetts: Final Generic Environmental Impact Report* (University of Massachusetts, June 2004), *The Practical Guide to Lake Management in Massachusetts* (ENSR International, 2004) and the *Policy on Lake and Pond Management for the Commonwealth of Massachusetts* (WRC, June 13, 1994).

9. **System Maintenance:** Perform regular leak detection surveys to maximize water conservation efforts and reduce stress on the wells, focusing on aging portions of distribution systems and reacting quickly to unusual increases in demand.

Continue to routinely check the water distribution system for cross-connections which could jeopardize public health or source integrity, and implement any associated recommendations offered by the surveyor. Evaluate the need to install an air gap on the dehumidifier drain line at Well #2.

Continue to look for opportunities to educate customers about cross-connection issues (such as via the HWD Consumer Confidence Report (CCR)). Consider offering low- or no-cost hose bibbs to customers to reduce the chance of backflow incidents, especially at utility sinks and outdoor hose connections.

If not already completed, create water system maps. Include all lines, valves and connections. For buried valves and connections, describe surface access points. Indicate the status of each line as active, inactive or abandoned. While engineering plans may not be necessary, consider the development of scaled maps at a minimum. If possible, GIS/GPS technology should be used.

Consider instituting a routine pump, pump column and well casing inspection program as part of the Town's maintenance schedule. The same preventive maintenance philosophies that apply to other Town equipment apply to wellhead components, with perhaps added importance due to the public health aspects of supplying water and the demanding physical conditions faced by buried systems. An inspection cycle of ten years or less is often recommended.

DEP often requests five-year inspections at storage tanks. Continue to clean and inspect the Bolton Road storage tank on a regular schedule. The tank was last inspected in 2002 and is due for its next inspection in approximately 2007.

Consider exercising and inspecting Well #3 periodically as part of the system maintenance program. If this well is to be relied upon as an emergency source, it should be kept in operating condition.

Plan and set aside funds, to the extent possible, to institute the routine inspection programs and repair or replace aging/damaged system components in the coming years. At the same time, funds should also be set aside for source protection activities such as those recommended in this report.

Check the outdoor end of the equipment vault drain pipe at Well #2 and install a durable screen if needed to prevent unwanted animal entry. Inspect the wellhead at Well #3 to assess the condition of the well cap and sanitary seal, and make corrective actions and remove vegetation as needed.

Document system operation procedures in the event of an emergency. Post those procedures in the pump house, equipment vault and a publicly accessible place at the HWD or DPW office, along with maintenance logs and descriptions of normal system startup-shutdown procedures.

MassRWA is available to provide technical assistance for municipal water system operations, maintenance and management if needed.

10. ***Well Yield Protection:*** Evaluate the feasibility of adding water level monitoring to the routine system inspection and sampling schedule for Wells #2/#5.

Water level data would document current site conditions and provide a basis for evaluating well/aquifer performance in addition to the possible negative impacts associated with drought periods or the installation of supply wells elsewhere in the SPAs. The data could also be used to assess/verify the sustainable yield of Wells #2 and #5 pumping simultaneously during peak demand situations.

One monitoring method is to install a small-diameter monitoring tube inside each well and use an electric/electronic manually-operated water level meter to measure water levels. Alternatively, consider installing automated water level transducers inside the wells instead of using a water level meter. Transducers would allow the Town to gather water level data without repeatedly accessing these critical wells, and could be tied into the new telemetry system.

Many vendors offer accurate transducers and data logging equipment, including Solinst (<http://www.solinst.com>), InSitu (<http://www.in-situ.com>), Global Water (<http://www.globalw.com>) and local distributors such as Carl Lueders & Company (<http://www.luederscompany.com>).

The costs of any well yield protection options need to be weighed against the likelihood of decreasing well yields. Without water level monitoring it is more difficult to predict the impending failure of a well due to clogged fractures, deteriorating pump performance, local water level declines, peak demands, etc.

11. **System Security:** Consider installing locking fenced enclosures or other types of protective barriers around the equipment vault at Well #2 and the wellhead at Well #3. At Well #2, the increased visibility of such a barrier would have to be weighed against possible security improvements.

Consider posting an outdoor drinking water supply protection sign at the Bolton Road facility entrance to notify visitors of the presence of the water system. Continue to negotiate for the installation of a locked gate on the access road to Well #3 that will satisfy DEP's sanitary survey request as well as allow public access to the old reservoir now used as a skating pond.

Review Section 6.0 for additional system security recommendations.

12. **Sanitary Survey/SWAP Report Follow-Up:** Continue addressing the actions recommended in the SWAP report and sanitary survey. If needed, re-submit copies of all MPA test results for 2003 through 2005 to DEP to address their sanitary survey request for additional testing at Wells #2/#5.

Submit a copy of this plan to DEP. Use the plan submittal as an opportunity to notify DEP that the Town is acting on their source protection recommendations and has proactively and voluntarily developed a comprehensive wellhead protection program that includes a detailed and updated land use inventory.

Notify DEP of the corrections to the mapped locations of Wells #2 and #5 (as shown in Appendix A). Field-verify the location of Well #3 on an aerial orthophoto prior to submitting the corrections.

13. **Future Land Uses & Regulatory Controls:** To the extent possible, avoid further development of Town properties within the SPAs and especially the Zone Is. Should facility repairs, upgrades or additions be planned, evaluate potential impacts on groundwater. If negative impacts are anticipated, consider changing or moving the proposed land uses. Maintain wooded buffers around the wells wherever possible.

Use LID and conservation design BMPs compatible with water resource protection (as described for PSOC #1). Contact groups such as NRWA, DEP, EOE, the Worcester County Conservation District (WCCD; <http://www.ma.nrcs.usda.gov/partnerships/conservationpartnership.html>), the UMass Extension Natural Resource & Environmental Conservation Program (NREC; <http://www.umass.edu/nrec>) and the Natural Resources Conservation Service (NRCS; <http://www.ma.nrcs.usda.gov>) for technical assistance if needed.

14. **Additional Water Quality Testing:** Review historical testing results for Well #3 to determine arsenic levels in groundwater. If no results are available, consider collecting a water sample from Well #3 to determine the arsenic concentration. This information may be useful in the event of emergency well activation.

15. **Preventive Monitoring:** Periodically evaluate long-term trends in the concentrations of water sampling parameters, including sodium and secondary contaminants. Increasing trends in concentration may point to developing issues and are best managed before they exceed an MCL or ORSG. Simple graphical

and/or tabular evaluation methods may be used. If a significant trend suggestive of declining water quality is noted, institute corrective actions.

If water level monitoring capabilities are developed (Recommendation #A10), periodically evaluate long-term water level trends in addition to well yields. Changing trends in water levels and associated yields may point to changes in well performance or aquifer conditions.

16. **Public Education:** Support the incorporation of groundwater protection principles into the public school curriculum and library materials. An increase in the public understanding and stewardship of groundwater resources will benefit the Town over the long-term via a lower risk of accidents, spills and vandalism.

Curricular assistance is available from many sources, including the Massachusetts Drinking Water Education Partnership (<http://www.madwep.org>), DEP, MassRWA, NREC, NRWA, Project Wet (<http://www.projectwetusa.org>) and the Environmental Education and Training Partnership (EETAP; <http://www.eetap.org>).

Project Wet is a nonprofit water education program and publisher for educators and young people ages 5-18. The program facilitates and promotes awareness, appreciation, knowledge and stewardship of water resources through the dissemination of classroom-ready teaching aids. EETAP is an EPA-funded environmental education training program for teachers and policymakers.

NRWA provides environmental education programs for students, teachers and the general public in a variety of settings including the classroom, schoolyard, library and/or park. In addition, they provide volunteer monitoring opportunities for children and adults of all ages in local water bodies.

NREC provides public education programs in addition to technical information and assistance on water quality management and is affiliated with the University of Massachusetts. MDWEP is a partnership of government agencies, water works associations and PWSs that protects drinking water supplies and public health by coordinating annual Drinking Water Week festivities and providing educational resources, kid's games and awards programs.

- B. **Other Properties** – The Town does not directly control non-municipal land uses, beyond the application of its current bylaws/regulations. However, as suggested above, there are many opportunities to influence land use decision-making at private sites within or near the SPAs. *Note: Some of the notification recommendations listed below overlap and could be implemented simultaneously (e.g. one notification letter with several BMP fact sheets could be sent to each landowner).*

1. **Massachusetts Avenue (PSOCs #1 & 5):** Notify state highway officials that portions of Route 111 are located in or near the SPAs. In particular, state that chemical spills or winter maintenance activities on that road have the potential to negatively impact water quality at the sources. Contact information and an example notification letter are attached in Appendix E.

It is our understanding that MassHighway typically uses a 3:1 to 4:1 sand-to-salt mixture at an application rate of approximately 240 pounds/mile for winter road maintenance. Request that the state limit their use of road salt on Route 111 during winter months and evaluate the feasibility of designating the section of that road extending from the village out past the WWTP as a “Reduced Salt Area” (RSA). Approximately 1,000 of the 13,500 road miles managed by MassHighway have been designated as RSAs (Keating, May/June 2001). RSAs are applicable to wetlands, groundwater recharge areas, drinking water sources and salt-sensitive agricultural and vegetative locations.

If needed, encourage the state to consider the de-icing alternatives and salt management strategies outlined in *Syntheses of Best Practices – Road Salt Management* (Transportation Association of Canada, 2003) and *Deicing Salt – Still on the Table* (Keating, May/June 2001).

Contact MECO at 800-322-3223 to assess the condition and possible fluid PCB-content of transformers along Route 111 in/near the SPAs. If PCBs are present, request that non-PCB containing fluids be used. If leaks or stains are observed, repair or request that the transformers be replaced. As applicable, review MECO emergency response procedures.

2. **Residences (PSOCs #1, 2, 3, 4, 6 & 7 – Parking Areas & Roads / Lawns & Fields / Sanitary Waste / Hazardous Materials & Waste / Petroleum Storage Systems / Animal Waste):** Notify the owners of residential properties in the SPAs that motor vehicle usage, parking area maintenance, fertilizer or pesticide applications, septic systems, HHW disposal, heating oil systems and pet waste disposal have the potential to negatively impact water quality at the wells. Contact information and example notification letters are included in Appendix D.

Encourage the owner(s) to follow BMPs for applicable PSOCs, including:

- *Residents Protect Drinking Water* (DEP, January 2002)
- *Healthy Lawns & Landscapes* (Center for Ecological Technology, May 2002)
- *Protecting Groundwater from Pesticides* (DAR, undated)
- *Protecting Water Sources from Fertilizer* (DAR, undated)
- *Septic Sense* (UMass Extension, undated)
- *Alternatives to Using Household Hazardous Substances* (Center for Ecological Technology, undated)
- *Reduce Your Use of Household Hazardous Products* (Center for Ecological Technology, undated)
- *Tips for Maintaining Your Home Heating System: Preventing Heating Oil Leaks and Spills* (DEP, May 2004)

Other helpful references are DEP’s comprehensive lists of HHW and heating oil spill prevention BMPs at <http://www.mass.gov/dep/recycle/reduce/househol.htm> and <http://www.mass.gov/dep/cleanup/homeownr.htm>, respectively.

Cleanups of home heating oil spills routinely cost MA residents between \$20,000 and \$50,000 each, and costs have exceeded \$300,000 in some cases (DEP,

January 2004). Recommend that heating oil users contact their insurance provider(s) and oil supplier(s) to assess coverage in the event of a spill.

Attach copies of the BMP guidance documents as appropriate to each notification letter, or at least refer the owners to the internet addresses where the documents can be downloaded. Consider including the schedule for HHW Collection Days in your area.

Consider completing a survey of all petroleum storage tanks in the SPAs. The survey would identify each tank's location, condition, type, size, age and last inspection date. Survey results could be cross-referenced with UST information currently filed at the Harvard Health Department. A similar survey could be conducted for septic systems. Either survey would provide an opportunity to educate residents about their role in groundwater protection.

Excellent sources of environmental self-assessment and self-help information for homeowners are available through the Home*A*Syst program sponsored by EPA, the Cooperative State Research, Education and Extension Service (CSREES) and the Natural Resources Conservation Service (NRCS). The program may be accessed at <http://www.uwex.edu/homeasyst>, or by calling NRCS at (508) 829-4477 or CSREES at (413) 545-4743.

3. **Professional Offices – Dentistry/Counseling (PSOCs #1, 3, 4 & 6):** Follow the suggestions and BMPs listed above under Recommendation #B2. Encourage businesses to review *Businesses Protect Drinking Water* (DEP, January 2002).

In addition, notify the dental offices that disposal of amalgam, cement and X-ray cleaners, fixers and developers in or near the SPAs has the potential to negatively impact water quality at the wells. Contact information and example notification letters are included in Appendix D.

Request basic information on waste handling practices, as well as mercury compliance certification or exemption records. Dental practices and facilities need to keep these records on-site to demonstrate their compliance with the *Amalgam Wastewater & Recycling Regulations for Dental Facilities* (310 CMR 73.00) that went into effect in April 2006.

Encourage the dentists to follow BMPs for waste disposal as needed, including those listed in *Dentistry and the Environment* (Massachusetts Water Resources Authority and Massachusetts Dental Society, January 1998) and on the DEP web site at <http://www.mass.gov/dep/service/dentalhg.htm>.

4. **Woodworking Facility (PSOCs #1, 3, 4 & 6):** Follow the suggestions and BMPs listed above under Recommendation #B2. Encourage the facility owner to review *Businesses Protect Drinking Water* (DEP, January 2002).

In addition, notify Harvard Custom Woodworking that some woodworking activities have the potential to negatively impact water quality at the wells. Contact information and example notification letters are included in Appendix D.

According to EPA, if the facility uses “any solvents, flammable or combustible liquids, combustible solids, ignitable paints containing flammable solvents, or

other materials containing toxic chemicals, the waste generated from using these materials might be hazardous, and [the facility] might be subject to RCRA requirements covering the generation, transportation and management of hazardous waste.” Request information on the facility’s chemical storage, handling and disposal practices, if applicable, and request to meet the owner(s) on-site to review facility operations if needed.

If a facility survey is conducted, determine whether or not floor drains are present. If the potential exists for pollutants to enter the ground via floor drains, then either the threat or the drains must be removed. Pay particular attention to any drains which ultimately discharge to the ground from chemical storage areas.

Encourage the owner to follow the pollution prevention and waste reduction BMPs in *A Guide to Pollution Prevention for Wood Furniture Finishing* (Dambek, Heltzer, Kelly, L’Annunziata and Smith, November 1992) and *Pollution Prevention for the Wood Finishing Industry* (EPA and Sedesol Pollution Prevention Workgroup, October 1994). Additional guidance on pollution prevention and BMPs for woodworking may be obtained from the Northeast Waste Management Officials Association (NEWMOA) at (617) 367-8558 or the Wood Furniture Manufacturing Topic Hub portion of their web site at <http://www.newmoa.org/prevention/topichub>.

As applicable, encourage the owner to follow the chemical reduction, exchange and management strategies outlined in *Managing Small Quantity Chemical Use to Prevent Contamination of Drinking Water* (EPA, July 2001). Request to be notified in the event of a chemical spill.

5. **Other Water Supply Wells:** The Town shares an interest in protecting groundwater resources with other small local PWSs as well as DMD due to their common withdrawals from Harvard’s aquifers. DEP strongly encourages such partners to work together to promote the development of protective measures that safeguard local drinking water. Consider contacting the other local water systems to discuss possible shared approaches to improving protection.

If the opportunity arises, other PWSs should be encouraged to develop or update source protection plans of their own (often available at no direct charge through MassRWA). Contact information for the PWSs is available from DEP.

Because the recharge areas for the Town and CGE are so close to one another and within close proximity to the northern shore of Bare Hill Pond, outreach may be initially aimed at CGE (978-456-3518) or their contract operator, Deborah Bray (978-486-1008). Perhaps there are opportunities to complete a small water-related project with the campers (Girl Scouts).

6. **Future Land Uses & Regulatory Controls:** Local plans for the future of the Town (including MP, OSRP and TCAP) contain recommendations that are very compatible with long-term drinking water needs and goals. Look for mutually beneficial opportunities to work with and support community groups on the initiatives recommended in those plans.

Notify the owners of vacant, developable lots and large, subdivide-able parcels in or near the SPAs that future development activities on their lands have the potential to negatively impact water quality and quantity. An example owner notification letter and the mailing addresses are included in Appendix D.

Encourage the use of “green” or LID BMPs compatible with water resource protection in the design of future land uses through direct and indirect communication with the above landowners. Refer the owners to NRWA, DEP, EOEA, WCCD, NREC and NRCS for technical assistance if needed. Encourage owners preparing to complete logging operations in the SPAs to follow the BMPs outlined above in Recommendation #A7.

Comprehensive state mapping indicates that aquatic, partially aquatic and terrestrial habitats in and near the SPAs are of statewide significance and a high priority target for conservation. Consequently, the Town and local conservation groups such as NRWA, HCT, WCCD and NRCS share a common interest in land protection. If the Town is interested in purchasing or obtaining easements on land in the SPAs, encourage HCC to contact these groups regarding options.

Consider seeking rights-of-first-refusal for purchases of:

- Privately-owned Zone I parcels (including Nos. 22A-4, 22A-5 and 22A-6) to improve protection and compliance for Wells #2 and #5;
- Large subdivide-able SPA parcels, especially No. 22-21 to improve protection and compliance near Well #3 should it be used again; and
- Parcels between Warren Avenue and Whitman Road should an alternative access to the Town Beach be considered to improve protection and compliance for Wells #2/#5 as suggested in Recommendation #A1.

Partial but permanent easements or restrictions might be considered for parcels with only small sections inside the Zone Is (Nos. 22A-4 and 22A-6). Easements or restrictions might also be considered for the large parcels given their importance to protecting the wells and potential conservation values.

In general, support the development of municipal bylaws/regulations that are protective of the environment. Such improvements would provide an additional and more permanent level of safety to account for both SPA delineation uncertainties and future changes in land use around the wells.

The lack of aquifer and watershed protection bylaws in Harvard makes local aquifers and the pond more susceptible to the possible negative impacts of future development. Encourage the Planning Board to create bylaws and mapping that satisfy DEP’s sanitary survey recommendation and reflect the protective land use controls listed in DEP’s *Drinking Water Regulations*. Protection districts should include the SPAs as well as the recharge areas of other local PWSs.

Encourage local officials to specify LID practices and conservation design methods in their site permitting processes. Support the development of new floor drain and updated earth excavation laws that eliminate potential conduits for groundwater contamination. These activities are best controlled through general bylaws or health regulations, which cover both current and future land uses.

MassRWA or DEP may be contacted for example bylaws and regulations if needed. The Montachusett Regional Planning Commission (MRPC) provides technical assistance with zoning and land use issues and may also be available to assist the Town in developing customized bylaws/regulations. MRPC can be reached at 978-345-7376 or online at <http://www.mrpc.org>.

7. ***Public Education:*** One possible approach to engaging the interest and support of local officials and residents is to schedule a “field trip.” Consider hosting a tour of the sources and SPAs. This approach has been very successful in other MA communities. BHPWMC and HWD may wish to co-host such an event.

Consider creating a drinking water protection brochure and distributing it to water users as well as landowners in the SPAs. The brochure would contain basic information on the wells, the aquifers and land use impacts on water quality, promoting the important theme of drinking water stewardship. Example brochures are available – contact MassRWA for assistance if needed.

In addition to sending a copy of this plan to DEP, a copy of this plan should be filed with the Town Clerk. Notification letters should be submitted to other appropriate regional, state and local officials. Contact information for officials recommended to receive either the SPP or a notification letter is included in Appendix E. An example notification letter is also provided in Appendix E.

By contacting these officials, the Town is showing them that protection of these water sources is a top priority and that a comprehensive plan to address all water supply concerns identified in the SWAP report and sanitary survey is in place.

This can have mutually beneficial impacts, such as the creation of unique funding opportunities for source protection, notification about relevant issues and events, or improvement of agency-supplier relationships. In Massachusetts, the SPP may also be used to strengthen statistical reports and applications for DEP chemical monitoring waivers.

Protection Committee Recommendations

According to DEP (November 2001), the Town should establish a drinking water protection team of two to five people. The team (or “committee”) for Harvard currently consists of Water Commissioners Dave Swain, Duane Barber and Ron Ricci as well as Department of Public Works Director Richard Nota and Foreman/Operator Ron Gilbert.

Team membership could also include other Town employees, customers, landowners in the SPAs and watershed/conservation agencies involved in protecting the environment. While admittedly a “tough sell” in some cases, the team should consider encouraging involvement from these other parties in person or in writing as opportunities arise.

An annual meeting of this committee would be a good way to routinely focus specifically on short- and long-term source protection issues.

Protection Recommendations Summary & Schedule

The protection committee should develop an implementation schedule for the above recommendations, based on available resources, threat levels and liability concerns. An exact schedule is *not* proposed here because MassRWA understands that the recommendation list is long, that implementation is voluntary and that the Town's material and financial resources for such efforts may be quite limited.

A summary of key recommendations is provided below. The committee should consider implementing urgent or relatively low-cost and less labor-intensive recommendations as soon as possible. Less urgent, more expensive or more time-consuming ideas should be prioritized for long-term implementation, as resources allow.

SUGGESTIONS FOR TOWN PROPERTIES

Short-Term

- Train/equip (as needed) staff to handle *accidental chemical spills* near the wells.
- Continue to minimize *road salt* use; plow snow away from Zone I if possible.
- Monitor *parking areas/roads* and quickly clean up motor fluid *spills*.
- Notify applicable *Town boards/staff* (including DPW, fire, school, library, beach, conservation, planning and pond officials) about the SPAs and BMPs; submit a copy of this SPP to the Town Clerk.
- Continue to avoid the use of *pesticides* at the school fields; carefully manage the application of *fertilizers*, if any.
- Review *water testing results*, if any, for the stream near the wells, and support *water quality studies* by groups such as NRWA/BHPWMC.
- Consider posting *notices* or *warning signs* at each Town facility regarding chemical spill, HHW, septic system and pet waste BMPs.
- Continue to maintain, monitor and document *WWTP operations*.
- Encourage the use of *non-hazardous* materials and properly store and manage all *hazardous* materials/waste.
- Inspect Town facilities for *floor drains* with the potential to pollute the ground; remove or repair as needed.
- Assess the condition and fluid PCB-content of *transformers* in the SPAs.
- Monitor and maintain *petroleum systems* in accordance with applicable rules and BMPs; discuss *spill response* issues with Town site managers/oil suppliers as needed and consider developing a *tank inventory/inspection file*.
- Continue to routinely *inspect* the SPAs and *maintain* water system equipment.
- Evaluate the need for an air gap on the *dehumidifier drain* at Well #2.
- Continue to routinely clean and inspect the *water storage tank*.
- Budget for long-term *equipment replacement* and *source protection* costs.

- Check the condition of the equipment vault *drain pipe outlet* at Well #2 and *wellhead cap/sanitary seal* at Well #3; repair if needed.
- Notify DEP of *well location corrections* and verify map location of Well #3.
- Consider posting a drinking water supply *sign* near Well #3 and continue to negotiate for a *locked gate* on the Well #3 access road.
- Submit this *SPP* to DEP to satisfy their sanitary survey recommendation.
- Evaluate the need to collect a water sample from Well #3 for *arsenic* analysis.
- Hold regular source protection *meetings*.
- Assess the system's level of readiness for *contingencies* and *emergencies* as described in Section 6.0.

Long-Term

- Evaluate the feasibility of modifying road areas to improve *Zone I compliance*.
- Monitor, map and maintain *storm drains* and encourage LID practices.
- Continue to explore the possibility of *expanding* sewer service.
- Install a modern *septic system* or provide a *sewer hookup* at the Town Beach.
- Replace or test the *fuel oil UST* at The Bromfield School; consider *ASTs* or *alternative heating fuels* at Town facilities in the SPAs.
- If *logging* is anticipated, follow the state's BMPs for water resource protection.
- Support the use of *non-chemical weed management* at Bare Hill Pond; follow applicable BMPs if *herbicides* must be used.
- Complete regular *leak surveys* and encourage *water conservation*.
- Routinely check for *cross-connections* and *share* the results with customers; encourage the use of *hose bibbs* by HWD customers.
- Prepare water *distribution system maps* as needed.
- Consider creating a routine pump/pump column/well casing *inspection program*.
- Consider periodically *exercising* and inspecting Well #3 to maintain operability.
- Consider adding *water level* monitoring to routine system operations.
- Consider installing protective *barriers* at Wells #2 (equipment vault) and #3.
- Avoid further *development* of Town properties in the SPAs.
- Continue to address *SWAP report* and *sanitary survey* issues as needed.
- Periodically evaluate *long-term trends* in water quality, level and yield.
- Promote *groundwater education* at the schools and library.

SUGGESTIONS FOR OTHER PROPERTIES

Short-Term

- Notify SPA *residents, businesses* and *state officials* about the SPAs and BMPs.

- Evaluate the feasibility of designating Route 111 as a *Reduced Salt Area* and encourage the state to use alternative salt management strategies.
- Investigate the condition/PCB content of *transformers* on Route 111.
- Encourage *SPA residents* to follow HHW, pesticide/fertilizer, septic system, heating oil and pet waste BMPs.
- Request chemical storage, waste handling and compliance information from the *dental offices* and *woodworking facility*.
- Specify *LID/conservation design* practices in the site permitting process.
- Develop and adopt *aquifer and watershed protection bylaws* to improve groundwater protection and include all SPAs on associated maps.
- Promote aquifer protection by hosting a *field trip* and/or creating a *brochure*.
- Encourage source protection *committee membership*.

Long-Term

- Consider completing petroleum storage tank and/or septic system *surveys*.
- Consider contacting other *local PWSs* about common aquifer protection concerns and encouraging them to develop or update SPPs.
- Support *local boards* implementing the MP, OSRP and TCAP.
- As needed, contact *local conservation groups* to assess land purchase/easement options in/near the SPAs or partnerships for conservation/education projects.
- Encourage local officials to amend *zoning/general bylaws* and *subdivision/health regulations* as needed to further improve groundwater protection, including the adoption of floor drain requirements and updated earth excavation laws.

Financial assistance for completing wellhead improvements, public outreach/education and many of these recommendations may periodically be available through various agencies. Contact DEP at (617) 556-1070 for further information on state wellhead protection or aquifer land acquisition grants programs. Contact MassRWA, MRPC, HCT, WCCD, NRCS, NREC, EOEI or other water departments for approaches to creative funding options and strategies. The AmeriCorps program (<http://www.americorps.org>) may provide a cost-effective means to implement some of the recommendations.

MassRWA envisions this SPP as a working document that will be reviewed and updated on a regular basis. Other water suppliers have determined that an annual review/update works best for them. We suggest that the protection committee identify a review/update schedule that works best for these wells and that the schedule is followed to ensure that the plan does not become outdated.

During SPP reviews, particular attention should be paid to changes in land use that have occurred since the last plan update. Guidance (from Vermont, where updates are required) on updating SPPs is found at <http://www.anr.state.vt.us/dec/watersup/swapp.htm>. A simple checklist could be developed from that document to assist the Town in quickly

completing the updates. More detailed guidance on SPP development and considerations is available in *Developing a Local Wellhead Protection Plan* (DEP, November 2001).

6.0 Supplemental Contingency Plan

The supplemental contingency plan (SCP) section of this SPP outlines the Town's options in the event that a source becomes contaminated, is at imminent risk of becoming contaminated (e.g., due to an oil or hazardous chemical spill) or temporarily declines in yield.

The SCP is not intended to cover widespread or long-term natural/nuclear disasters. However, the SCP may also be useful if there are short-term power outages, mechanical problems or vandal/terrorist attacks. According to DEP, small PWSs tend to be less protected and thus more vulnerable to those types of attacks.

The above situations may result in the temporary or even permanent loss of drinking water at the Town's water supply facilities. Being prepared for potential contingencies and emergency situations will greatly improve the Town's ability to quickly and effectively respond to such problems and reduce the negative impacts of those problems.

The Town has an *Emergency Response Plan* (ERP) for HWD and produces an ERP directory for their water system in each annual statistical report. The ERP was not reviewed prior to preparation of this SCP.

This SCP is intended to supplement the ERP and provide general recommendations in accordance with the *Handbook for Water Supply Emergencies* (DEP, August 2002). The SCP may be used to assist the Town in amending or updating its ERP (modern ERPs commonly include sections on contingency planning, including a review of current system conditions and future water needs). This SCP also supplements the source protection recommendations provided earlier in this report.

The above-referenced DEP handbook includes guidelines for ERP preparation and outlines detailed procedures for evaluating and responding to a wide variety of emergencies, including those addressed by this SCP. According to the DEP handbook, all water supply emergencies share a common response methodology:

- 1) Begin documenting the situation using a standardized form.
- 2) Investigate, evaluate and identify the type of emergency.
- 3) Activate emergency response team.
- 4) Notify appropriate authorities, users and local news media as needed.
- 5) Correct the problem and seek advice/assistance as needed.
- 6) Finalize incident documentation.
- 7) Monitor problem resolution and maintain readiness for changes.

The following parts of this section describe each of the above response issues relative specifically to the types of situations listed above. A list of short-term and long-term water

supply alternatives is included. For further information on contingency and emergency planning, please consult the DEP handbook or contact MassRWA for assistance.

Incident Documentation

An example of a standardized emergency incident documentation form (“Emergency Response Checklist”) is attached in Appendix F. This form or a comparable document should be started upon receipt of the first incident report, and updated periodically as the response proceeds. Upon incident completion, the form should be checked for accuracy and a final copy should be submitted to the DEP office in Worcester, Massachusetts.

Emergency Identification

Using quickly available information, resources and observations, as well as the initial incident report, the water supplier should identify the most probable type (or “Level”) of emergency. Five basic types of emergencies (Levels I through V, in order of increasing severity) have been classified by DEP as shown in Appendix F. Once the type of emergency is identified, the specific response procedures (as described in the DEP handbook) applicable to that type should be followed.

Response Team Activation

The response team for this water system includes at least two HWD representatives. If the person discovering the emergency situation is not one of the team members, that person should immediately call a team member. The team includes:

- DPW Director: Richard Nota (978) 456-4130 (w)
(508) 369-1444 (c)
- Primary Operator: Ronald Gilbert (978) 456-4130 (w)
(978) 386-0064 (h)

The Town should encourage annual response team meetings to review possible emergency scenarios.

Notification Procedures

The response team may notify a variety of local, state and/or regional officials in accordance with the ERP and depending on the nature of the emergency situation. It is typically the superintendent’s responsibility to first determine who should be notified on the list provided below. The Town’s chain-of-command for notification should be clearly identified and documented.

Emergency phone numbers are provided for the water system in the most recent ERP directory. Each member of the response team should maintain a copy of that notification list in a readily accessible location, including any facilities housing water system equipment. The Town should cross-reference that list with the list provided below to identify any additional emergency contacts that may be useful.

- Local:

Fire/Police/Ambulance Emergency	911**
Nashoba Valley Medical Center (Ayer)	(978) 784-9000*
Health Alliance (Leominster)	(978) 466-2000*
Nashoba Associated Boards of Health	(978) 772-3335*
Harvard Police Department	(978) 456-1212*
Harvard Fire Department	(978) 456-3648*
Harvard Board of Health	(978) 456-4106*
Harvard Town Administrator	(978) 456-4100*
Harvard Highway Department	(978) 456-4130*
Harvard Emergency Management Director	(978) 456-3648*

- State:

MA State Police	(508) 923-3014*
MA State Fire Marshal	(978) 567-3111*
	(508) 820-2000**
MA DEP - Drinking Water Program – Boston	(617) 292-5770*
MA DEP - Central Region Office – Worcester	(508) 792-7650*
MA DEP – 24-Hour Spill Reporting Line	(888) 304-1133**
MA Department of Public Health	(617) 624-6000*
	(617) 522-3700**
MA Poison Control Center	(800) 682-9211**
MA Nuclear Incident Advisory Team	(617) 727-9710**
MA Emergency Management Agency	(508) 820-2000**

- Federal:

EPA – Boston	(617) 918-1111*
National Response Center	(800) 424-8802**
Federal Emergency Management Agency	(617) 223-9540**
Occupational Safety & Health Administration	(800) 321-6742*
Communicable Disease Center – Atlanta	(800) 311-3435*
Federal Aviation Administration (Accidents)	(781) 238-7001**
Federal Bureau of Investigation	(617) 742-5533**

* Day Time

** 24 Hours

Once agencies on this list are notified, some of the agencies may become part of the emergency response team for that incident. A descriptive summary of how emergency response actions are managed in Massachusetts and a brief guide to security decision-making for water utilities are included in Appendix F. DEP generally plays a lead role during water supply emergencies, providing instructions to the supplier on appropriate response actions and required sampling and notifications.

An online summary (DEP, August 2003) of public notification requirements for water suppliers is provided for review at <http://www.mass.gov/dep/water/laws/publnot.htm>. Of particular concern is the determination of violation status during bacterial contamination incidents. A guide to violation determination is provided in the DEP handbook.

All threats or suspected acts of terrorism against a water system must be reported to the Local Police and State Police. The police will determine if the Federal Bureau of Investigation will be notified. Suspected terrorist threats or suspicious activities may be reported to the State Police on the Terrorism Tip Line at (888) USA-5458. Additional data on preparing for terrorism is available at <http://www.state.ma.us/eops/emergencies.htm>.

The primary responsibility for cleaning up spills of oil or hazardous material rests with both the party that caused or contributed to the spill and the owner of the property where the spill happened. DEP notification is not required in all cases, but all spills must be cleaned up so that there is no risk to human health. Depending on the size and type of spill, a number of local, state and federal agencies may have a role in the emergency response. A detailed description of spill management procedures is provided in *Managing Spills of Oil and Hazardous Materials* (DEP, April 2006).

It may be appropriate to advise local news media of the situation if the emergency is classified as Level III or above. The DEP handbook provides guidance on working with media and issuing press releases. A partial listing of local media contacts is provided below (contacts currently listed by the Town are shown in italics):

- *Harvard Post* (978) 456-8122
- Harvard Hillside (978) 772-0777
- Sentinel & Enterprise (978) 343-6911
- Concord Journal (978) 369-2800
- Worcester Telegram & Gazette (508) 793-9100
- Lowell Sun (978) 458-7100

- *WCVB Channel 5 ABC* (781) 449-0400
- *WHDH Channel 7 NBC* (800) 280-8477
- WBZ-TV Channel 4 CBS (617) 787-7000
- WGBH Channel 2 PBS (617) 300-2000
- WFXT Channel 25 FOX (781) 326-8825

- *WTAG 580 AM* (508) 795-0580
- WCRN 830 AM (508) 792-5803
- WCAP 980 AM (978) 458-1266
- WAZN 1470 AM (508) 424-2568

- WSRS 96.1 FM (508) 757-9696
- *WCRB 102.5 FM* (781) 893-7080
- WXLO 104.5 FM (800) 649-1045
- WAAF 107.3 FM (617) 779-5400

Corrective Actions & Alternative Water Sources

During this phase of the incident response, the response team and local, state and federal officials (as applicable) act together to isolate the cause of the emergency and complete corrective actions.

The list of possible causes and solutions for a variety of incidents is beyond the scope of this SCP, and there may be more than one solution for a given incident. However, the Town should periodically attempt to identify the most significant system vulnerabilities and consider possible remedies should those types of incidents occur.

In the event of an emergency, it is possible that someone other than the response team may be asked to access the wellheads and assist the Town with system operation. Consequently, important phone numbers should be posted in accessible locations at all pump houses and equipment rooms as well as headquarters to assist emergency personnel. In addition, a description of basic system startup and shutdown procedures should be completed and posted. The latter item may be particularly valuable in situations where regular system operators are not available, and should include a description of emergency power options.

According to HWD and DEP, power outages are infrequent. However, HWD is researching the feasibility of acquiring an emergency generator for use during crisis situations. If a generator is purchased, the equipment vault and pump house should be checked and modified as needed for readiness to connect to the generator.

The immediate availability of outside technical assistance may be critical to the success of an incident response. If not already completed, a complete list of local contractors (including excavators, waterworks equipment suppliers, well and distribution system repair firms, carpenters, electricians, plumbers, etc.) who will back up in-house staff should be prepared by the Town prior to an emergency situation. It is our understanding that HWD currently uses the following excavator and equipment suppliers:

- J.T. Gould Excavating, Harvard (978) 456-8585
- Stiles Company, Norwood (800) 930-5645
- Bay State Water Works Supply, Littleton (800) 336-2235

To prepare for an accidental spill of oil or hazardous chemicals, the Massachusetts Licensed Site Professional (LSP) Board may be contacted at (617) 556-1091 for a list of environmental consultants. It is our understanding that the Town has been using Cushing, Jamallo & Wheeler (CJW) of Clinton at (978) 368-6320 for consulting services at The Bromfield School. Review spill response procedures/options with CJW or other consultants serving central Massachusetts to ensure LSP availability prior to an emergency incident. Other consultants include:

- CMG Environmental, Southbridge (508) 765-8510
- Pine & Swallow Associates, Groton (978) 448-9511
- Selden Environmental Services, E. Longmeadow (413) 567-5566
- Response Environmental, Worcester (508) 795-0110

A list of hazardous/toxic waste transporters (DEP, May 2005) may be obtained at <http://www.mass.gov/dep/recycle/hazardous/transport.htm> in case of an accidental spill of oil or hazardous chemicals. It is our understanding that the Town uses Clean Harbors (CH) of Norwell at (800) 282-0058 for routine hazardous waste transport services. In the event CH is not available or does not offer emergency services, other firms serving southeast Massachusetts include:

- EQ Northeast, Wrentham (508) 384-6151
- New England Disposal Tech., Shrewsbury (800) 698-1865
- Southworth Milton (508) 634-3400
- North Country Environ. Services, Milford (508) 888-5478

If the wells are temporarily or permanently disabled and (a) the reserve volume in the system storage tank is not sufficient to handle the emergency and (b) system demands have been reduced to the extent possible through pressure reductions or mandatory cutbacks, an alternative or treated source of water may be supplied to water users with DEP approval. Short-term water supply alternatives may include:

- Activation of Well #3
- Bottled water delivery
- Bulk water (sanitary tank truck) delivery
- Short-term treatment

The first short-term contingency option is the activation of Well #3 via a DEP-issued Declaration of Water Supply Emergency. With DEP approval, the well could be temporarily used to supply the system as was done in the 1990's. Under this scenario and assuming no equipment problems, the well would be activated in a period of six to eight hours according to HWD. Activation would entail receiving and installing five portable iron-and-manganese softening units from Friot's Water Treatment Co. (FWT) of Ayer (978-772-6773) as well as energizing the pump and adjusting valves as needed. The piping, valves and reconnection points for the filters are maintained in a state of readiness for this eventuality.

While the availability of Well #3 as an emergency source is an excellent short-term management technique, it is dependent on the availability of expensive rental treatment units and a number of unpredictable situations could result in a delay of the well's usage. Such situations could include physical deterioration/damage of the pump or well casing/screen, chemical problems due to groundwater contamination events that may have arisen since the 1990's, etc. In addition, it is our understanding that breakthrough occurs rather quickly in the softening units due to the elevated iron levels. Consequently, the Town should consider periodically inspecting/exercising the well as recommended in Section 5.0 and identify at least one other short-term contingency option.

A second short-term contingency option is the use of bottled water. Bottled water cannot be used as a long-term solution but may be used to temporarily avoid an unreasonable risk to health (DEP, March 18, 1993) in site-specific instances. A partial list of bottled water suppliers serving central Massachusetts includes:

- Berkshire Springs, Southfield (413) 229-2086
- VT Natural (Leader Distrib. Sys.), Brattleboro, VT (802) 254-6093
- Crystal Belmont Springs, Bridgewater (800) 444-7873
- Poland Spring (Nestle Waters), Poland, ME (800) 759-9365
- Polar Beverage, Worcester (800) 734-9800
- Bayberry Hill Spring Water, Townsend (978) 597-3204
- Mohawk Trail Spring Water, Marlboro (508) 485-6766
- Vermont Pure, Randolph, VT (800) 525-0070
- Dalton Water, Braintree (800) 504-0429

The Massachusetts Department of Public Health (DPH) may be contacted at (617) 983-6700 for additional bottled water supplier information if needed. If the Town wishes to use bottled water as a short-term contingency option, more than one supplier should be contacted to review supply procedures/options prior to an emergency incident. Additionally, the chosen suppliers should be permitted by DPH.

Bulk water deliveries are a third short-term contingency option. Guidelines (DEP, August 25, 2003) for bulk water deliveries may be reviewed online at <http://www.state.ma.us/dep/brp/dws/files/guides/9109.doc>. If the Town will be accepting bulk water in an emergency, the response team should select and meet with a bulk water transporter to verify that the system is equipped to receive deliveries. A partial list of transporters serving central Massachusetts is provided below. Bottled water suppliers and other PWSs may also offer bulk water delivery service.

- Dalton Water, Braintree (800) 504-0429
- Gavlak Enterprises, Somers, CT (860) 763-1266
- Harris Milk Transport, Palmer (800) 451-1714

An alternative bulk water storage option for special or priority users is the use of a flexible bladder tank which can be stored in its collapsed form onsite or at another convenient location. As with a permanent storage tank, “flex-tank” use will require prior planning and coordination with the bulk water supplier with regards to tank placement, connections, disinfection and cold-weather procedures. Flex-tank vendors (examples include: <http://www.atlinc.com>, <http://www.sei-ind.com>, <http://www.interstateproducts.com> and <http://www.packatank.com>) may be contacted for additional information.

Many short-term treatment options are available to the response team as a fourth short-term contingency option. For a variety of chemical and microbiological contaminants, firms providing emergency drinking water treatment services may be contacted. In addition to FWT, these firms include:

- U.S. Filter, Lowell (800) 525-0658
- Culligan Water Conditioning, Lowell (800) 842-1116
- Secondwind Water Systems, Manchester, NH (800) 287-5767

Other treatment firms may be identified by reviewing the local phone book or contacting local contract operators, equipment suppliers, environmental engineers, trade

associations or DEP. Several treatment services providers should be contacted to review service procedures, options and availability prior to an emergency incident.

In the event of a bacterial contamination incident, a Boil Water Order could be issued by state officials in accordance with DEP guidelines (DEP, January 10, 1996). However, the most common method of disinfecting PWSs in the event of an emergency is treatment with chlorine. After evaluating the source of the contamination and flushing the system, chlorination may be implemented either with temporary equipment and supplies or a permanently installed system.

A general description of temporary chlorination procedures is available at <http://www.des.state.nh.us/factsheets/ws/ws-4-3.htm> (NH Department of Environmental Services, 1998). Helpful web sites detailing the options, advantages and disadvantages associated with permanent standby chlorination systems include:

- http://c3.org/chlorine_issues/disinfection/c3white2003.html
- <http://water.montana.edu/training/gw>
- <http://www.p2pays.org/ref/01/00025.pdf>
- <http://www.oas.org/usde/publications/unit/oea59e/ch23.htm>
- <http://www.chlorine-generator.com/DrinkingWater.html>
- http://www.waterchlorination.com/water/news_detail.asp?news_id=29

The Town should identify which emergency chlorination option is best-suited for its system. Permanent standby systems may be preferred to facilitate implementation and reliability in the event of an emergency. Funding programs associated with homeland security initiatives may be a potential source of grants for equipment purchases.

It is our understanding that the Town is currently considering the installation of a tablet chlorination system for the equipment vault. A similar system was recently installed by the Belchertown Water Department (BWD). The BWD Superintendent (Tim Lofland; 413-323-6987) may be able to assist the Town in evaluating chlorination options.

In the unfortunate event of a major system failure at the Pond Road wells, long-term water supply alternatives include:

- Connecting to the nearest PWS with sufficient capacity;
- Installing a long-term contaminant-specific treatment system;
- Finding and constructing a new or replacement source; or
- Changing Well #3's status from Emergency to Active.

Major system failures where these options would be employed are most likely to be the result of a significant contamination incident on Pond Road. In that scenario, a long-term solution at some significant distance from Wells #2 and #5 will be needed.

The Town does not currently possess an interconnection with another PWS, and is unlikely to develop an interconnection in the near future due to the two-plus mile minimum

distance to the nearest community PWS (DMD). Thus, an interconnection does not currently appear to be a reasonable long-term water supply alternative for the Town.

Each of the remaining long-term options will require detailed planning, sufficient funding and DEP approval prior to implementation. Source construction and treatment regulations are detailed in the *Guidelines and Policies for Public Water Systems* (DEP, 2001), available online at <http://www.mass.gov/dep/water/laws/policies.htm>, and related policy documents. Local water supply and treatment firms referenced above may assist the Town in evaluating long-term options relative to those regulations.

A discussion of long-term treatment options is beyond the scope of this document and depends on the specific type and degree of contamination. If a significant contamination incident occurs, the Town will rely on short-term treatment and/or supply alternatives to give officials time to evaluate long-term treatment options.

Unfortunately, treatment may not be effective for all contaminant situations and one or more wells may be permanently abandoned in a worst-case scenario. If permanent abandonment of the Pond Road wells is required, it is essential that the Town have at least one alternative source of water as a viable long-term backup plan. The location of a new groundwater supply would need to meet DEP Zone I land use requirements and be:

- Close enough to the existing distribution system to be practically feasible;
- Far enough away from the current well(s) in case of a contamination incident;
- As distant from developed areas and roads as possible; and
- Outside of floodplain and wetland areas if possible.

While the Town owns a sizable amount of land in the vicinity of their water systems, the choices for additional well locations may still be constrained by the above limitations. This situation is further compounded by the facts that:

- System demand appears to be growing by at least 100,000 gallons per year;
- Current sources may not meet peak demands and emergency flows;
- The combined safe yield of Wells #2 and #5 is unclear based on available data and may be less than the total of the individually approved yields;
- No medium- or high-yield stratified drift aquifers are located nearby; and
- The bedrock aquifers typically produce low to moderate yields.

To understand what the combined sustainable yield of Wells #2 and #5 is under peak demand situations, the Town should consider monitoring water levels and yields at those wells during a combined pumping period or identifying historical data in the HWD files to support such an analysis (the August 1997 pumping test data for Well #5 may be a possibility if Well #2 was operating at that time). A qualified environmental consulting firm or MassRWA can assist the Town in estimating the sustainable yield based on that data.

As mentioned in Section 4.0, the Town is in the process of re-testing a potential well site west of The Bromfield School. The test well had an estimated yield of approximately 32 GPM but radionuclide levels that were potentially unacceptable at the time. If the

approvable yield is similar to that previously observed and water quality is determined to be sufficient or can be treated to acceptable levels, this test well will be a valuable addition to the water system and a viable long-term contingency option.

If the test well site is not successful, the Town could consider changing the status of Well #3 from Emergency to Active. This would require bringing the well into compliance with DEP's new source approval requirements in Chapter 4 of the *Guidelines and Policies for Public Water Systems*. It is our understanding that the potential cost and effort associated with the above activities, as well as the poor water quality and need for permanent treatment, were significant incentives for identifying the test well site and developing Well #5. These issues are compounded by the fact that were Well #3 to be approved for active use, its Zone I would likely not extend past Route 111 and could thus be limited to a maximum yield of about 14 GPM. Therefore, it seems unlikely that the Town would choose to pursue bringing Well #3 permanently online.

The only remaining new source option is to conduct a feasibility study that seeks to identify alternative backup well sites. It is our understanding that preliminary groundwater exploration studies were completed in the 1980's and 1994. If a feasibility study is completed, the qualified environmental consulting firm selected to conduct the study should account for and build upon the previous exploratory work using modern mapping and geophysical methods as well as a survey of local well logs and water quality data.

A modern groundwater exploration study may be a prudent investment for the Town regardless of the success or failure of the test well site currently under consideration. The Town should consider completing such a study because of the limiting factors governing well site selection described above, particularly long-term growth in demand versus the difficulty of finding adequate well sites with a sufficient degree of protection.

If an easement on or purchase of Parcel 22-21 is possible, it is feasible that a new source could be installed east of Well #3. Depending on the yield and water quality at the new well, it could replace or supplement Well #3. A new well site to the east would have the advantage of an increased potential Zone I radius and corresponding increase in approvable yield. However, the site should be carefully selected using the modern exploration techniques described above prior to expending a lot of resources.

In summary, based on the short- and long-term contingency analysis provided above, the Town should focus on protecting their current supply wells, continuing to prepare for short-term alternatives (by making sure that Well #3 is ready for use and identifying one other short-term solution) and evaluating backup source options (new groundwater sources) in the event of a major incident. Such planning will ensure a reliable, relatively worry-free secondary source of drinking water in the event of most minor and major emergencies.

Contingency Recommendations Summary

The response team should be aware that an emergency can restart or change in intensity or character at any time. Consequently, it is vital that the team continually monitor conditions at the wells and within the associated recharge areas and maintain a level of readiness to respond to incidents which may threaten water quality or quantity. Methods of

monitoring and incident preparation, including those highlighted previously in this Section, are summarized below.

- Periodically *test* incident documentation/identification, response team activation and notification procedures.
- *Meet* with local fire, police and emergency management teams.
- Assess the sufficiency of *ERP directory*; maintain and regularly review/update the *ERP* as needed.
- Implement the source protection *recommendations* provided in Section 5.0.
- Maintain or develop *agreements* with bottled/bulk water suppliers, local contractors, equipment suppliers and hazardous waste disposal firms.
- Develop *agreements* with treatment service providers, an LSP and a water supply engineer, if not already completed.
- Maintain a *list* of contractors, suppliers, treatment firms and consultants.
- *Post* emergency contact and startup/shutdown procedures in accessible areas.
- Assess system *readiness* for emergency generators.
- Consider periodically *exercising* and inspecting Well #3 to maintain operability.
- Evaluate and select the most feasible *standby chlorination* option.
- Select a *backup* short-term contingency option for non-bacterial incidents.
- Identify long-term source options for *worst-case scenarios*, including completion of further studies at the 1996 test well.
- Consider completing a modern town-wide groundwater *exploration study*, including an evaluation of potential improvements to Well #3.
- Research and *budget* for short-term and long-term contingencies.

MassRWA has provided the above information solely to assist the Town with contingency planning in the event of an emergency. MassRWA does not necessarily endorse or recommend any vendors, service providers or manufacturers listed in this SPP/SCP. The Town should independently evaluate and select the most appropriate vendors, service providers and manufacturers for its emergency and source protection needs.

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APPENDIX A

FIGURES

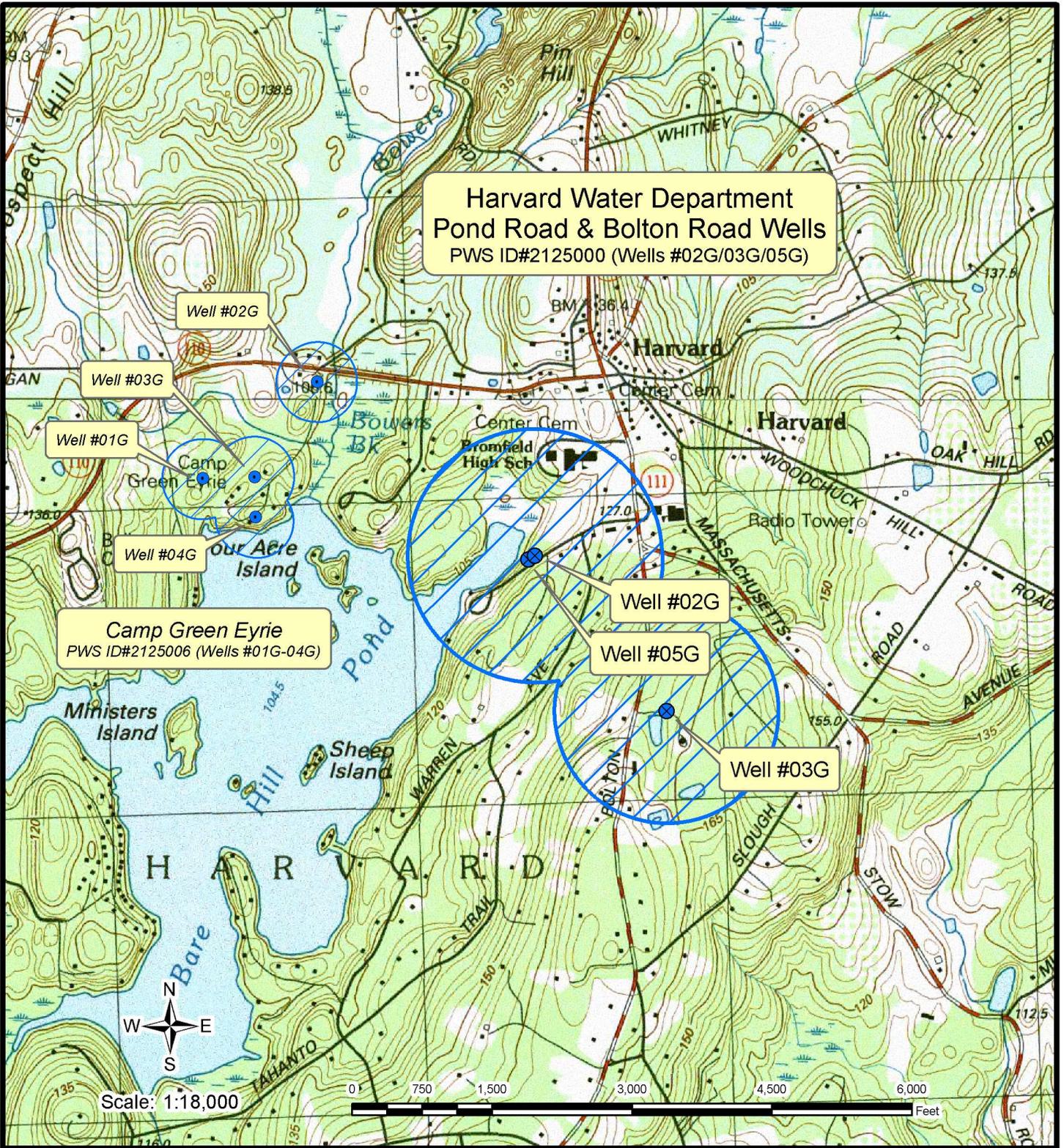
Figure 1 – Site Locations

Figure 2 – Bedrock Geology

Figure 3 – Potential Sources of Contamination

Figure 4 – Land Uses & Wetlands

Figure 5 – Property Boundaries (Approx.)



Legend

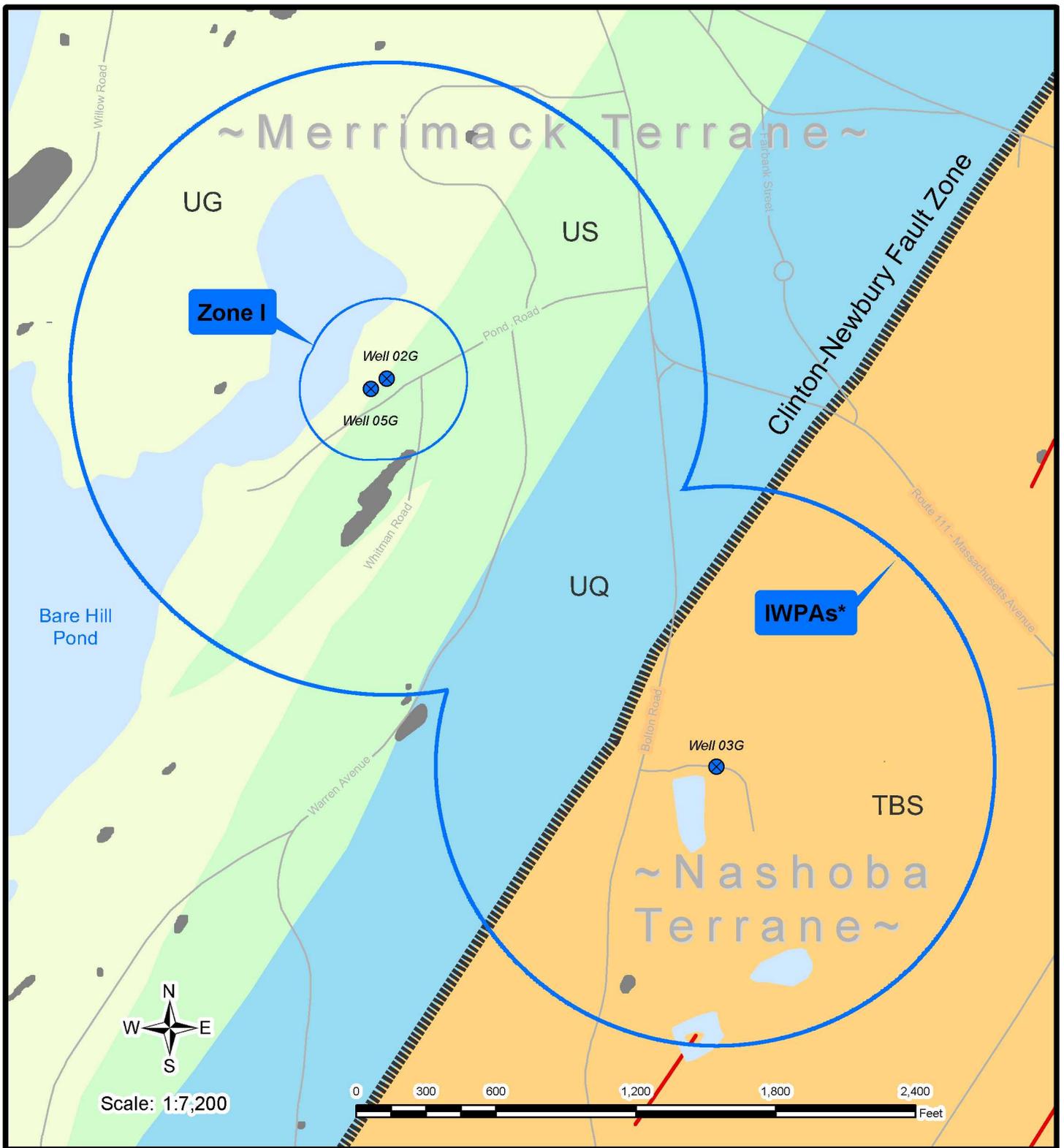
-  Public Water Supply Well - HWD
-  Public Water Supply Well - Other
-  Interim Wellhead Protection Area (HWD)
(Includes estimated "IWPA" for Well 03G)
-  Interim Wellhead Protection Area (Other)

**Figure 1
SITE LOCATIONS
Pond Road & Bolton Road Wells, Harvard, MA
PWS ID# 2125000**

Author: MAH
Date: 06/06



Source(s): MassGIS Topo Quad Images q193914 & q197914, 12/95
MassGIS PWS & IWPA Datalayers, 06/05; See text re: HWD IWPA delineation



Legend

- Public Water Supply Well - HWD
- Tadmuck Brook Schist (TBS)
- Unnamed gneiss (UG)
- Unnamed schist (US)
- Unnamed quartzite (UQ)
- Pegmatite / Outcrop

Source(s): Preliminary maps - Hudson quadrangle (Kopera, undated; Mabee, 2005)
 Geological Survey Bulletin 1038 (Hansen, 1956)
 Bedrock Geologic Map of MA (Zen and others, 1983)
 MassGIS PWS Datalayer, 06/05; Locations of Wells #2/#5 adjusted based on field data.
 *See text re: HWD IWPA delineation/estimation.

Figure 2
BEDROCK GEOLOGY

Pond Road & Bolton Road Wells, Harvard, MA
 PWS ID# 2125000

Author: MAH
 Date: 06/06



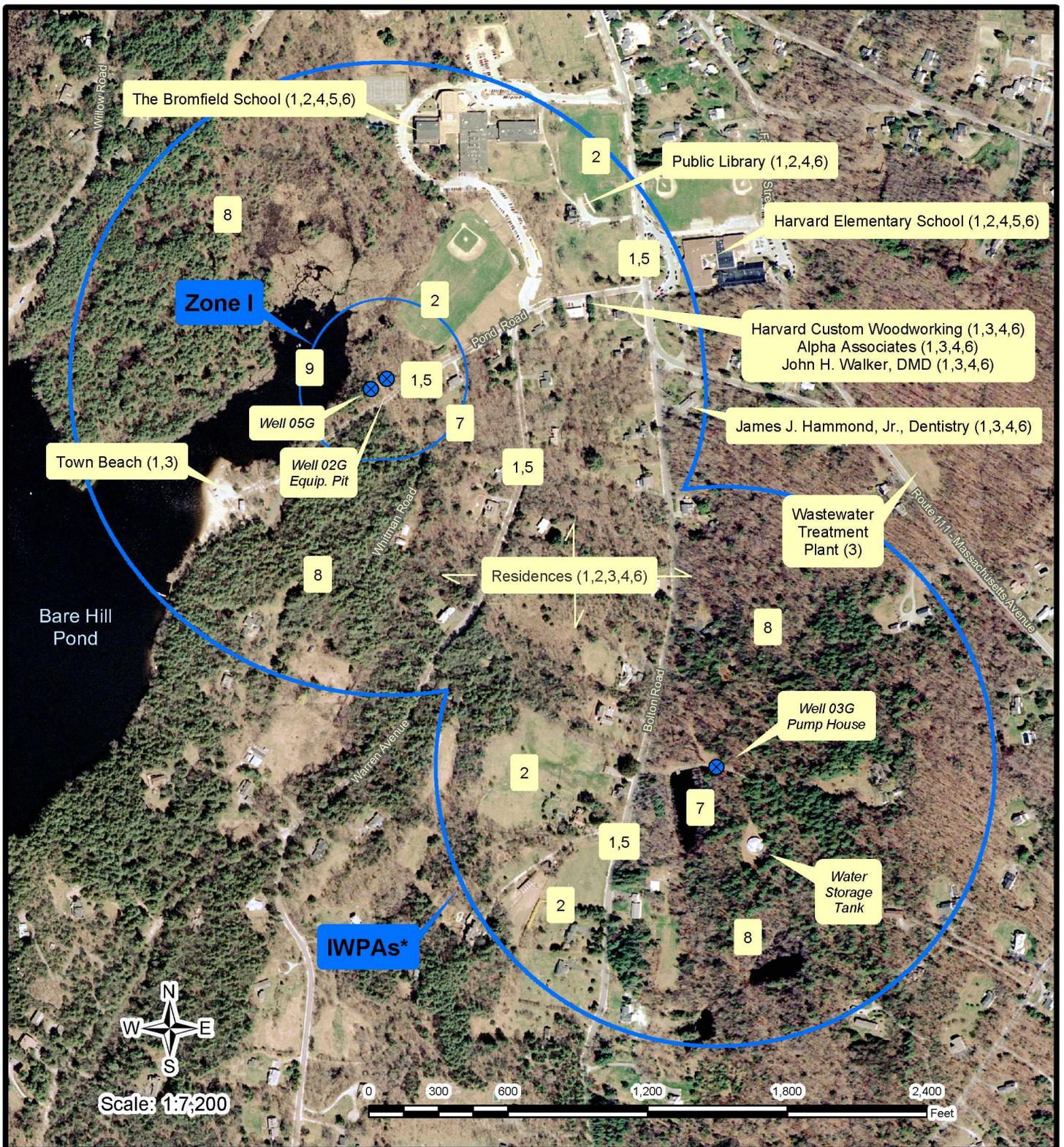


Figure 3
POTENTIAL SOURCES OF CONTAMINATION
 Pond Road & Bolton Road Wells, Harvard, MA
 PWS ID# 2125000

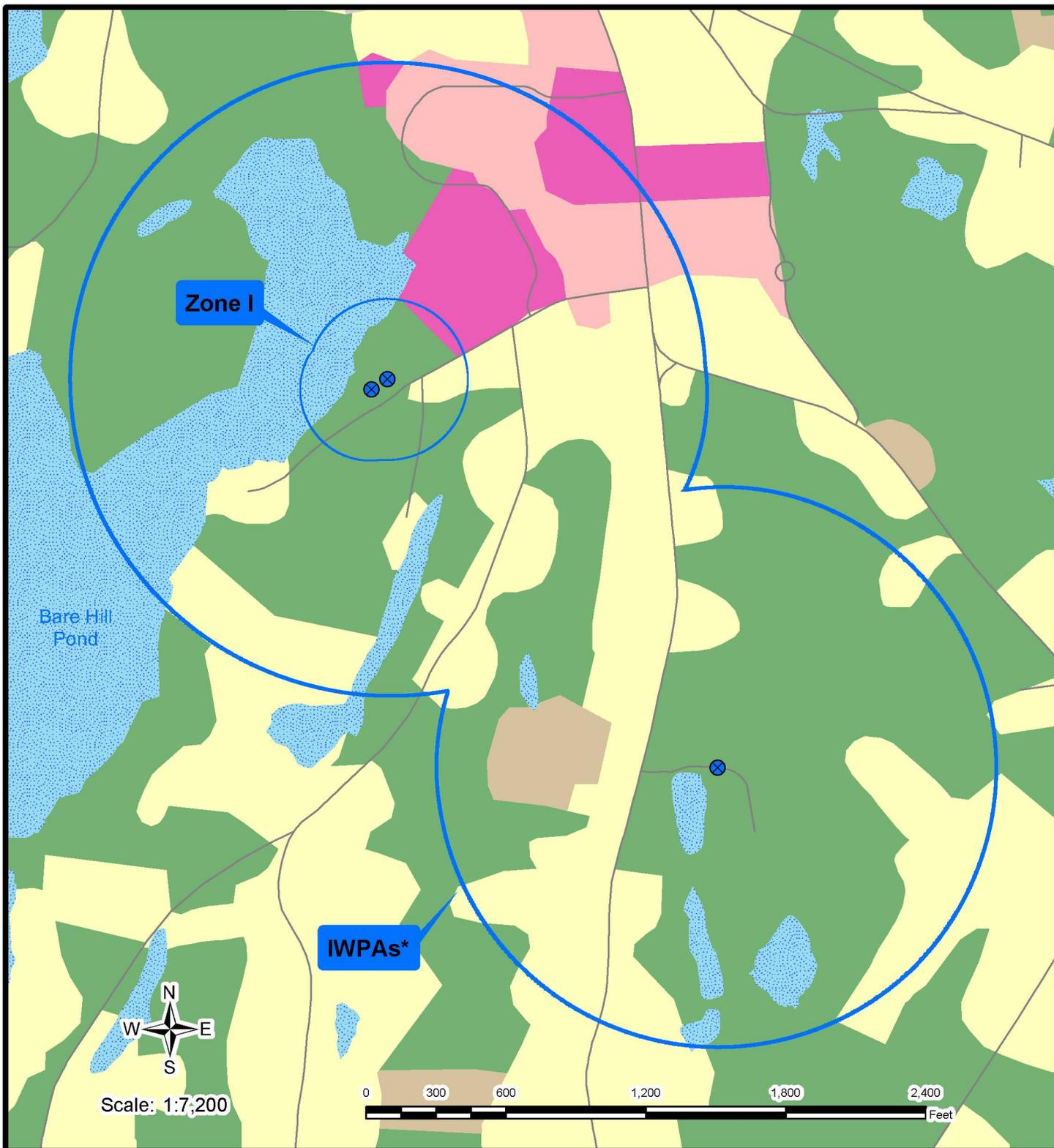
Legend

-  Public Water Supply Well - HWD
-  Potential Source of Contamination (see text for description)

Author: MAH
 Date: 06/06



Source(s): MassGIS Color Digital Orthophoto Images 193914 & 197914, 04/01
 MassGIS PWS Datalayer, 06/05; Locations of Wells #2/#5 adjusted based on field data.
 *See text re: HWD IWPA delineation/estimation.



Legend

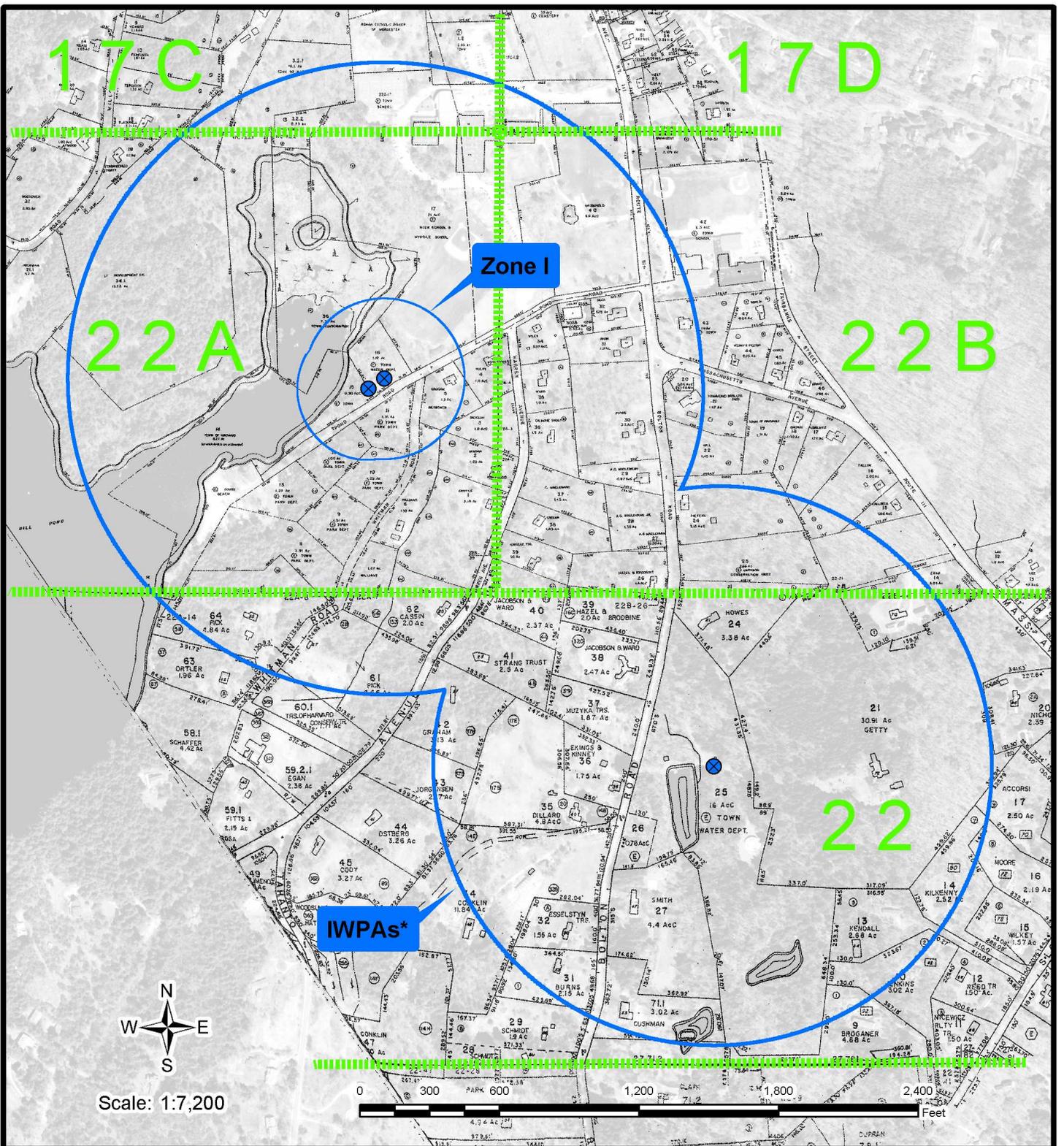
- Residential
- Forest
- Recreational Fields/Courts
- Urban Open Land/School
- Field/Crop/Pasture
- Wetland/Pond
- Road

Source(s): MassGIS PWS (06/05), Wetlands (03/06) & Land Use (01/02) Datalayers
 Locations of Wells #2/#5 adjusted based on field data.
 *See text re: HWD IWPA delineation/estimation.

Figure 4
LAND USES & WETLANDS
 Pond Road & Bolton Road Wells, Harvard, MA
 PWS ID# 2125000

Author: MAH
 Date: 06/06





Zone I

IWPAs*

Scale: 1:7,200

0 300 600 1,200 1,800 2,400 Feet

Legend

 Public Water Supply Well - HWD

 Assessor's Map No./Boundary

Figure 5
PROPERTY BOUNDARIES (Approx.)
 Pond Road & Bolton Road Wells, Harvard, MA
 PWS ID# 2125000

Author: MAH
 Date: 06/06

Source(s): MassGIS Color Digital Orthophoto Images 193914 & 197914, 04/01
 Harvard Assessor's Maps 17C, 17D, 22A, 22B, 22 & 27, 01/05
 MassGIS PWS Datalayer, 06/05; Locations of Wells #2/#5 adjusted based on field data.
 *See text re: HWD IWPA delineation/estimation.



APPENDIX B

POTENTIAL SOURCES OF CONTAMINATION INVENTORIES

Table B1 – PSOC s Inventory (Wells #2 and #5)

Table B2 – PSOCs Inventory (Well #3)

TABLE B1 - PSOCs INVENTORY
WELLS #02G & 05G – HARVARD WATER DEPARTMENT, HARVARD, MA

Property Id. #	Rd. #	Address	Site Use Code ¹	Zone I or IWPA	Primary PSOCs	Associated COCs ²
17C-1.2	----	Still River Road	903	IWPA	Parking	G/D, MO, WO, M, S
17C-2	15	Still River Road	906	IWPA	Church Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
17C-3.2.1	----	Still River Road	903	IWPA	Vacant	----
17C-3.2.2	----	Still River Road	132	IWPA	Vacant	----
17C-4	23	Still River Road	101	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22-60.1	----	Warren Avenue	905	IWPA	Vacant	----
22-61	----	Whitman Road	106	IWPA	Vacant?	----
22-62	20	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22-63	32	Whitman Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-64	30	Whitman Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22A-1	16	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22A-2	10	Warren Avenue	101	I+IWPA	Parking, Lawn, HHW, Septic System, Pets	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22A-3	----	Whitman Road	132	I+IWPA	Vacant	----
22A-4	15	Pond Road	101	I+IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage, Pets	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22A-5	19	Pond Road	101	I+IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage, Pets	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22A-6	13	Whitman Road	101	I+IWPA	Parking, Lawn, HHW, Septic System, Pets	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22A-7	----	Whitman Road	132	IWPA	Vacant	----
22A-8	----	Whitman Road	903	IWPA	Vacant	----
22A-9	----	Whitman Road	903	IWPA	Vacant	----
22A-10	----	Whitman Road	903	I+IWPA	Vacant	----
22A-11	----	Pond Road	903	I+IWPA	Vacant	----
22A-12	----	Pond Road	903	I+IWPA	Vacant	----
22A-13	----	Pond Road	903	IWPA	Vacant	----
22A-14	----	Pond Road	903	I+IWPA	Beach Parking, Pond Maintenance, Septic System, HHW, Pets	Fe, Pe, G/D, MO, WO, M, C, S, Mi, N
22A-15	----	Pond Road	903	I+IWPA	Vacant	----
22A-16	----	Pond Road	903	I+IWPA	Vacant (Wells 02G/05G)	----

Property Id. #	Rd. #	Address	Site Use Code ¹	Zone I or IWPA	Primary PSOCs	Associated COCs ²
22A-17	----	Pond Road	903	I+IWPA	School Parking, Lawn, Ballfields, HHW, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, N, HO
22A-34.1	----	Willow Road	601	IWPA	Vacant	----
22A-36	----	Pond Road	903	I+IWPA	Vacant	----
22B-20	----	Mass. Avenue	903	IWPA	Vacant	----
22B-21	40	Mass. Avenue	031	IWPA	Parking, HHW, Septic System, Fuel Storage, Dental Office Waste	G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-22	----	Bolton Road	132	IWPA	Vacant	----
22B-29	10	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22B-30	4	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22B-31	36	Mass. Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-32	32	Mass. Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-34	9	Pond Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-35	5	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-36	9	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-40	24	Mass. Avenue	905	IWPA	Library Parking, Lawn, HHW, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, N, HO
22B-42	27	Mass. Avenue	903	IWPA	School Parking, Lawn, Ballfields, HHW, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, N, HO
22B-43	39	Mass. Avenue	903	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-1033 22B-2033 22B-3033	5	Pond Road	340	IWPA	Parking, HHW, Septic System, Fuel Storage, Dental Office Waste, Woodworking Waste	G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-38	26	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-39	----	Bolton Road	130	IWPA	Vacant	----
22-40	----	Warren Avenue	132	IWPA	Vacant	----
22-41	25	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-42	27	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-24	13	Bolton Road	109	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22B-26	20	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-27	----	Bolton Road	132	IWPA	Vacant	----
22B-28	----	Bolton Road	130	IWPA	Vacant	----
22B-37	----	Warren Avenue	130	IWPA	Vacant	----
22B-38	17	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-39	19	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N

Property Id. #	Rd. #	Address	Site Use Code ¹	Zone I or IWPA	Primary PSOCs	Associated COCs ²
----	----	Mass. Avenue	----	IWPA	Road, Transformer(s)	G/D, MO, WO, M, S
----	----	Bolton Road	----	IWPA	Road, Transformer(s)	G/D, MO, WO, M, S
----	----	Pond Road	----	I+WPA	Road, Transformer(s)	G/D, MO, WO, M, S
----	----	Warren Avenue	----	IWPA	Road, Transformer(s)	G/D, MO, WO, M, S
----	----	Whitman Road	----	I+WPA	Road, Transformer(s)	G/D, MO, WO, M, S

NOTES:

- (A) "----" = Not available / not applicable. Primary PSOCs shown for all parcels intersecting the IWPA(s) but forestry is not included.
- (B) Information concerning the presence and/or type of septic systems and heating systems was obtained from the Harvard Assessor's office.
- (C) "HHW" = Household Hazardous Waste. HHW includes everyday items that contain toxic ingredients, such as adhesives, art and hobby supplies, automotive fluids, batteries, bleach, cleaners and detergents, lawn and garden products, paints and thinners, fluorescent lights, mercury-containing thermometers and switches, etc. HHW is a concern for groundwater quality if these products are used or no longer needed, and discarded improperly to the ground, storm sewers or septic systems.
- (D) Site Use Codes for each parcel are identified as shown on property cards at the local Assessor's Office. The codes are described in *Property Type Classification Codes* (MA Department of Revenue, November 2002).

¹KEY to SITE USE CODES:

101 = Single-family Residence	903 = Tax-exempt, Municipalities/Districts	601 = Forest Land (Chapter 61)
106 = Residential Accessory Land with Improvement	905 = Tax-exempt, Charitable Organizations	
109 = Multiple Residences	906 = Tax-exempt, Churches/Synagogues/Temples	
130 = Developable Residential Land	031 = Multiple-use, primarily Commercial	
132 = Un-developable Residential Land	340 = General Office Building	

²KEY to COCs

Mi, N = *Microbes, Nutrients* = Associated with decomposition of decaying organics from septic systems, manure deposition, etc. Microbes include viruses/bacteria/protozoans.

Fe, Pe = *Fertilizers, Pesticides* = Associated with chemical storage/application for lawn/field care and utility line maintenance; may include cyanide. Pesticides include herbicides, insecticides, rodenticides, fungicides and disinfectants. These items commonly include synthetic organic compounds (SOCs).

HO = *Heating Oil* = Associated with oil spills & failures of aboveground or underground storage tank systems; commonly includes semi-volatile organic compounds (SVOCs).

Pa, G/D, MO, C = *Paint products, gasoline/diesel fuel, motor oil, cleaners (including solvents)* = Associated with chemical spills, disposal and runoff on the ground and in septic systems or storm drains, in both residential and non-residential settings. Commonly include volatile organic compounds (VOCs).

WO = *Waste Oil* = Associated with oil spills, disposal and runoff from vehicle maintenance and commercial/industrial operations; often contains heavy metals and organic compounds; may contain PCBs in association with electrical equipment.

M = *Metals* = Associated with oil spills, disposal and runoff from vehicle maintenance and commercial/industrial operations. This category may include other common IOCs such as cyanide, arsenic or fluoride in association with wastewater discharges from septic systems or treatment plants.

S = *Salt* = Associated with winter road and driveway deicing as well as runoff from highway maintenance facilities.

U = *Unknown* = Associated with hazardous or toxic freight on railroad tracks and roads, or the dumping of unknown materials in gravel pits.

TABLE B2 - PSOCs INVENTORY
WELL #03G – HARVARD WATER DEPARTMENT, HARVARD, MA

Property Id. #	Rd. #	Address	Site Use Code ¹	Zone I or IWPA	Primary PSOCs	Associated COCs ²
22-38	26	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-39	----	Bolton Road	130	IWPA	Vacant	----
22-40	----	Warren Avenue	132	IWPA	Vacant	----
22-41	25	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-42	27	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-24	13	Bolton Road	109	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22B-26	20	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-27	----	Bolton Road	132	IWPA	Vacant	----
22B-28	----	Bolton Road	130	IWPA	Vacant	----
22B-37	----	Warren Avenue	130	IWPA	Vacant	----
22B-38	17	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-39	19	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22-9	92	Slough Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-10	82	Slough Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-13	84	Slough Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-14	80	Slough Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-16	72	Slough Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-17	70	Slough Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-20.1	86	Mass. Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-21	72	Mass. Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-24	21	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-25	----	Bolton Road	903	IWPA	Vacant (Well 03G)	----
22-26	----	Bolton Road	903	IWPA	Vacant	----
22-27	47	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-29	58	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-31	52	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-32	50	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-34	42	Bolton Road	109	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
22-35	40	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N

Property Id. #	Rd. #	Address	Site Use Code ¹	Zone I or IWPA	Primary PSOCs	Associated COCs ²
22-36	36	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-37	30	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-43	33	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22-44	41	Warren Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-14	70	Mass. Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-15	64	Mass. Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-16	62	Mass. Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-17	54	Mass. Avenue	101	IWPA	Parking, Lawn, HHW, Septic System, Fuel Storage	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N, HO
22B-25	----	Bolton Road	905	IWPA	Vacant	----
27-71.2	71	Bolton Road	101	IWPA	Parking, Lawn, HHW, Septic System	Fe, Pe, G/D, MO, WO, M, C, S, Pa, Mi, N
----	----	Bolton Road	----	IWPA	Road, Transformer(s)	G/D, MO, WO, M, S

NOTES:

- (E) "----" = Not available / not applicable. Primary PSOCs shown for all parcels intersecting the IWPA(s) but forestry is not included.
- (F) Information concerning the presence and/or type of septic systems and heating systems was obtained from the Harvard Assessor's office.
- (G) "HHW" = Household Hazardous Waste. HHW includes everyday items that contain toxic ingredients, such as adhesives, art and hobby supplies, automotive fluids, batteries, bleach, cleaners and detergents, lawn and garden products, paints and thinners, fluorescent lights, mercury-containing thermometers and switches, etc. HHW is a concern for groundwater quality if these products are used or no longer needed, and discarded improperly to the ground, storm sewers or septic systems.
- (H) Site Use Codes for each parcel are identified as shown on property cards at the local Assessor's Office. The codes are described in *Property Type Classification Codes* (MA Department of Revenue, November 2002).

¹KEY to SITE USE CODES:

101 = Single-family Residence
109 = Multiple Residences

130 = Developable Residential Land
132 = Un-developable Residential Land

903 = Tax-exempt, Municipalities/Districts
905 = Tax-exempt, Charitable Organizations

²KEY to COCs:

Mi, N = *Microbes, Nutrients* = Associated with decomposition of decaying organics from septic systems, manure deposition, etc. Microbes include viruses/bacteria/protozoans.
Fe, Pe = *Fertilizers, Pesticides* = Associated with chemical storage/application for lawn/field care and utility line maintenance; may include cyanide. Pesticides include herbicides, insecticides, rodenticides, fungicides and disinfectants. These items commonly include synthetic organic compounds (SOCs).
HO = *Heating Oil* = Associated with oil spills & failures of aboveground or underground storage tank systems; commonly includes semi-volatile organic compounds (SVOCs).
Pa, G/D, MO, C = *Paint products, gasoline/diesel fuel, motor oil, cleaners (including solvents)* = Associated with chemical spills, disposal and runoff on the ground and in septic systems or storm drains, in both residential and non-residential settings. Commonly include volatile organic compounds (VOCs).
WO = *Waste Oil* = Associated with oil spills, disposal and runoff from vehicle maintenance and commercial/industrial operations; often contains heavy metals and organic compounds; may contain PCBs in association with electrical equipment.
M = *Metals* = Associated with oil spills, disposal and runoff from vehicle maintenance and commercial/industrial operations. This category may include other common IOCs such as cyanide, arsenic or fluoride in association with wastewater discharges from septic systems or treatment plants.
S = *Salt* = Associated with winter road and driveway deicing as well as runoff from highway maintenance facilities.
U = *Unknown* = Associated with hazardous or toxic freight on railroad tracks and roads, or the dumping of unknown materials in gravel pits.

APPENDIX C

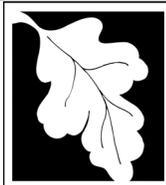
ABBREVIATED SOURCE PROTECTION PLANS

Wells #2/#5

*DEP Certification Form
Abbreviated Source Protection Plan
Source Protection Area Map*

Well #3

*DEP Certification Form
Abbreviated Source Protection Plan
Source Protection Area Map*



Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program
Wellhead Protection Plan Checklist
Guidelines for Small Systems (sources pumping <100,000gpd)

Developing a Wellhead Protection Plan (WHPP) is integral to ensuring a good clean drinking water supply. Key components of an approved WHPP include: Establishing a protection committee/team - Defining the wellhead protection area - Identifying potential sources of contamination - Protecting and managing the wellhead protection area, and - Conducting ongoing public education and outreach.

This checklist can be used to ensure your plan meets DEP guidelines. If you would like to be notified of developing an approved Wellhead Protection Plan, please complete and submit this form to DEP's Drinking Water Program in Boston. For assistance in developing a WHPP, see DEP's guidance document 'Developing a Local Wellhead Protection Plan' at the Program's web site: <http://www.mass.gov/dep/brp/dws>.

System Name: Harvard Water Department

PWS ID#: 2125000

Municipality: Harvard, MA

Wells (01G, 02G etc): 02G & 05G

- ✓ **The plan identifies the wellhead protection committee/team members - a committee or team can consist of the water supplier and certified operator.**
- ✓ **The plan includes a current map of the Zone I/IWPA that shows (or lists) the current land uses - conduct an inspection and locate the land uses on your Zone I/IWPA map; or, refer to your SWAP Report/map or most recent DEP site exam report.**
- ✓ **The plan describes the existing protection measures in place – include all measures that currently protect the water supply, i.e. posted protection signs; fencing; Zone I inspections; land purchases; conservation restrictions; land owner agreements; threats (UST, septic) removed from Zone I/IWPA; drainage improvements; Best Management Practices; secondary containment installed; or municipal bylaws/health regulations that include the Zone I/IWPA.**
- ✓ **The plan identifies potential threats to the water supply and the protection strategies to address them - See list above for protection strategies.**
- ✓ **The plan includes public education/outreach – such as providing source protection informational material or notification letters to land owners in the Zone I/IWPA, or posting signs in facilities located in the Zone I.**
- ✓ **The plan includes a timeline (schedule) for accomplishing the identified protection strategies - For example;**
 1. Remove septic system from Zone I- June 2005
 2. Fence pump house – September 2005

Improve drainage around wellhead – March 2006

Sign:

Date:

ABBREVIATED SOURCE PROTECTION PLAN

PWS ID# 2125000, WELLS #02G & 05G – HARVARD WATER DEPARTMENT,
HARVARD, MA

Source Protection Committee: The committee for the Harvard Water Department (HWD) currently consists of Water Commissioners Dave Swain, Duane Barber and Ron Ricci as well as Department of Public Works Director Richard Nota and Foreman/Operator Ron Gilbert.

Inspection & Land Use Map: A source protection area (SPA) inspection including Zone I was completed on October 27, 2005. Physical land features, potential sources of contamination (PSOCs) identified during the inspection and subsequent research, land use designations, and property boundaries within the SPA are shown in Appendix A of the comprehensive source protection plan (SPP). Land uses are summarized on the attached map.

Existing Protection Measures: In addition to requesting the comprehensive SPP, the Town has actively sought to implement protection measures at their facilities including:

- Regularly *inspecting* the SPAs and maintaining *neat, sanitary* facilities;
- Installing a PWS *sign* and locking *gate/doors* at Pond Road;
- Periodically *cleaning* the water storage tank and assessing *cross-connections*;
- Investigating preventive chlorine *disinfection* options;
- Pursuing additional groundwater *sources*;
- Adding an experienced *manager* and new *operator* to the HWD staff;
- Enlisting experienced *volunteer* assistance with capacity improvement;
- Aggressively pursuing sanitary survey requirements *and* recommendations;
- Investing in a custom *telemetry* system and *main replacement* program; and
- Incorporating potential *security improvements* for the Bolton Road pump house access road into a proposed utility project.

The Town has also proactively promoted other projects designed to improve groundwater protection such as:

- Conveying *sewage* from the schools/library outside of the SPAs;
- Completing a *wastewater district* feasibility study which includes Pond Road;
- Enhancing nutrient removal thru *innovative* technology at the wastewater treatment plant (WWTP);
- Minimizing *road salt* usage;
- Avoiding outdoor *pesticide* use at the schools; and
- Timely, comprehensive *cleanup* of the oil spill at The Bromfield School.

Potential Threats & Protection Strategies: Potential threats to this water supply include at least nine PSOCs. PSOCs are identified on the attached map and include:

<u>PSOC ID. #</u>	<u>Potential Threat</u>	<u>Threat Ranking</u>
1	Parking Areas & Roads	Moderate-High
2	Lawns & Fields	Moderate
3	Sanitary Waste	Moderate-High
4	Hazardous Materials & Waste	Low-Moderate
5	Electrical Distribution Equipment	Low-Moderate
6	Petroleum Storage Systems	Moderate-High
7	Animal Waste	Low
8	Forestry	Low
9	Pond Weed Management	Low

Other issues relevant to the protection of this water supply include: System Maintenance, Well Yield Protection, System Security, Sanitary Survey/SWAP Report Follow-up, Future Land Uses & Regulatory Controls, Preventive Monitoring, Public Education and Other Water Supply Wells.

Based on a review of the potential threats and other issues relevant to the protection of this water supply, a number of specific regulatory and non-regulatory (including best management practices or BMPs) action items are suggested. More information on each action item, including detailed descriptions of related threats and links to helpful resources, is provided in the comprehensive SPP.

Acronyms listed below are identified in the comprehensive SPP. The suggested action items (or protection measures) are:

SUGGESTIONS FOR TOWN PROPERTIES

Short-Term

- Train/equip (as needed) staff to handle *accidental chemical spills* near the wells.
- Continue to minimize *road salt* use; plow snow away from Zone I if possible.
- Monitor *parking areas/roads* and quickly clean up motor fluid *spills*.
- Notify applicable *Town boards/staff* (including DPW, fire, school, library, beach, conservation, planning and pond officials) about the SPAs and BMPs; submit a copy of this SPP to the Town Clerk.
- Continue to avoid the use of *pesticides* at the school fields; carefully manage the application of *fertilizers*, if any.
- Review *water testing results*, if any, for the stream near the wells, and support *water quality studies* by groups such as NRWA/BHPWMC.
- Consider posting *notices* or *warning signs* at each Town facility regarding chemical spill, HHW, septic system and pet waste BMPs.
- Continue to maintain, monitor and document *WWTP operations*.
- Encourage the use of *non-hazardous* materials and properly store and manage all *hazardous* materials/waste.
- Inspect Town facilities for *floor drains* with the potential to pollute the ground; remove or repair as needed.
- Assess the condition and fluid PCB-content of *transformers* in the SPAs.
- Monitor and maintain *petroleum systems* in accordance with applicable rules and BMPs; discuss *spill response* issues with Town site managers/oil suppliers as needed and consider developing a *tank inventory/inspection file*.
- Continue to routinely *inspect* the SPAs and *maintain* water system equipment.
- Evaluate the need for an air gap on the *dehumidifier drain* at Well #2.
- Continue to routinely clean and inspect the *water storage tank*.
- Budget for long-term *equipment replacement* and *source protection* costs.
- Check the condition of the equipment vault *drain pipe outlet* at Well #2 and *wellhead cap/sanitary seal* at Well #3; repair if needed.
- Notify DEP of *well location corrections* and verify map location of Well #3.
- Consider posting a drinking water supply *sign* near Well #3 and continue to negotiate for a *locked gate* on the Well #3 access road.
- Submit this *SPP* to DEP to satisfy their sanitary survey recommendation.
- Evaluate the need to collect a water sample from Well #3 for *arsenic* analysis.

- Hold regular source protection *meetings*.
- Assess the system's level of readiness for *contingencies* and *emergencies* as described in Section 6.0.

Long-Term

- Evaluate the feasibility of modifying road areas to improve *Zone I compliance*.
- Monitor, map and maintain *storm drains* and encourage LID practices.
- Continue to explore the possibility of *expanding* sewer service.
- Install a modern *septic system* or provide a *sewer hookup* at the Town Beach.
- Replace or test the *fuel oil UST* at The Bromfield School; consider *ASTs* or *alternative heating fuels* at Town facilities in the SPAs.
- If *logging* is anticipated, follow the state's BMPs for water resource protection.
- Support the use of *non-chemical weed management* at Bare Hill Pond; follow applicable BMPs if *herbicides* must be used.
- Complete regular *leak surveys* and encourage *water conservation*.
- Routinely check for *cross-connections* and *share* the results with customers; encourage the use of *hose bibbs* by HWD customers.
- Prepare water *distribution system maps* as needed.
- Consider creating a routine pump/pump column/well casing *inspection program*.
- Consider periodically *exercising* and inspecting Well #3 to maintain operability.
- Consider adding *water level* monitoring to routine system operations.
- Consider installing protective *barriers* at Wells #2 (equipment vault) and #3.
- Avoid further *development* of Town properties in the SPAs.
- Continue to address *SWAP report* and *sanitary survey* issues as needed.
- Periodically evaluate *long-term trends* in water quality, level and yield.
- Promote *groundwater education* at the schools and library.

SUGGESTIONS FOR OTHER PROPERTIES

Short-Term

- Notify SPA *residents, businesses* and *state officials* about the SPAs and BMPs.
- Evaluate the feasibility of designating Route 111 as a *Reduced Salt Area* and encourage the state to use alternative salt management strategies.
- Investigate the condition/PCB content of *transformers* on Route 111.
- Encourage *SPA residents* to follow HHW, pesticide/fertilizer, septic system, heating oil and pet waste BMPs.
- Request chemical storage, waste handling and compliance information from the *dental offices* and *woodworking facility*.
- Specify *LID/conservation design* practices in the site permitting process.
- Develop and adopt *aquifer and watershed protection bylaws* to improve groundwater protection and include all SPAs on associated maps.
- Promote aquifer protection by hosting a *field trip* and/or creating a *brochure*.
- Encourage source protection *committee membership*.

Long-Term

- Consider completing petroleum storage tank and/or septic system *surveys*.

- Consider contacting other *local PWSs* about common aquifer protection concerns and encouraging them to develop or update SPPs.
- Support *local boards* implementing the MP, OSRP and TCAP.
- As needed, contact *local conservation groups* to assess land purchase/easement options in/near the SPAs or partnerships for conservation/education projects.
- Encourage local officials to amend *zoning/general bylaws* and *subdivision/health regulations* as needed to further improve groundwater protection, including the adoption of floor drain requirements and updated earth excavation laws.

Methods of emergency monitoring and incident preparation, including contingency planning for alternative sources of water, are also discussed in the comprehensive SPP. The resulting recommendations are:

- Periodically *test* incident documentation/identification, response team activation and notification procedures.
- *Meet* with local fire, police and emergency management teams.
- Assess the sufficiency of *ERP directory*; maintain and regularly review/update the *ERP* as needed.
- Implement the source protection *recommendations* provided in Section 5.0.
- Maintain or develop *agreements* with bottled/bulk water suppliers, local contractors, equipment suppliers and hazardous waste disposal firms.
- Develop *agreements* with treatment service providers, an LSP and a water supply engineer, if not already completed.
- Maintain a *list* of contractors, suppliers, treatment firms and consultants.
- *Post* emergency contact and startup/shutdown procedures in accessible areas.
- Assess system *readiness* for emergency generators.
- Consider periodically *exercising* and inspecting Well #3 to maintain operability.
- Evaluate and select the most feasible *standby chlorination* option.
- Select a *backup* short-term contingency option for non-bacterial incidents.
- Identify long-term source options for *worst-case scenarios*, including completion of further studies at the 1996 test well.
- Consider completing a modern town-wide groundwater *exploration study*, including an evaluation of potential improvements to Well #3.
- Research and *budget* for short-term and long-term contingencies.

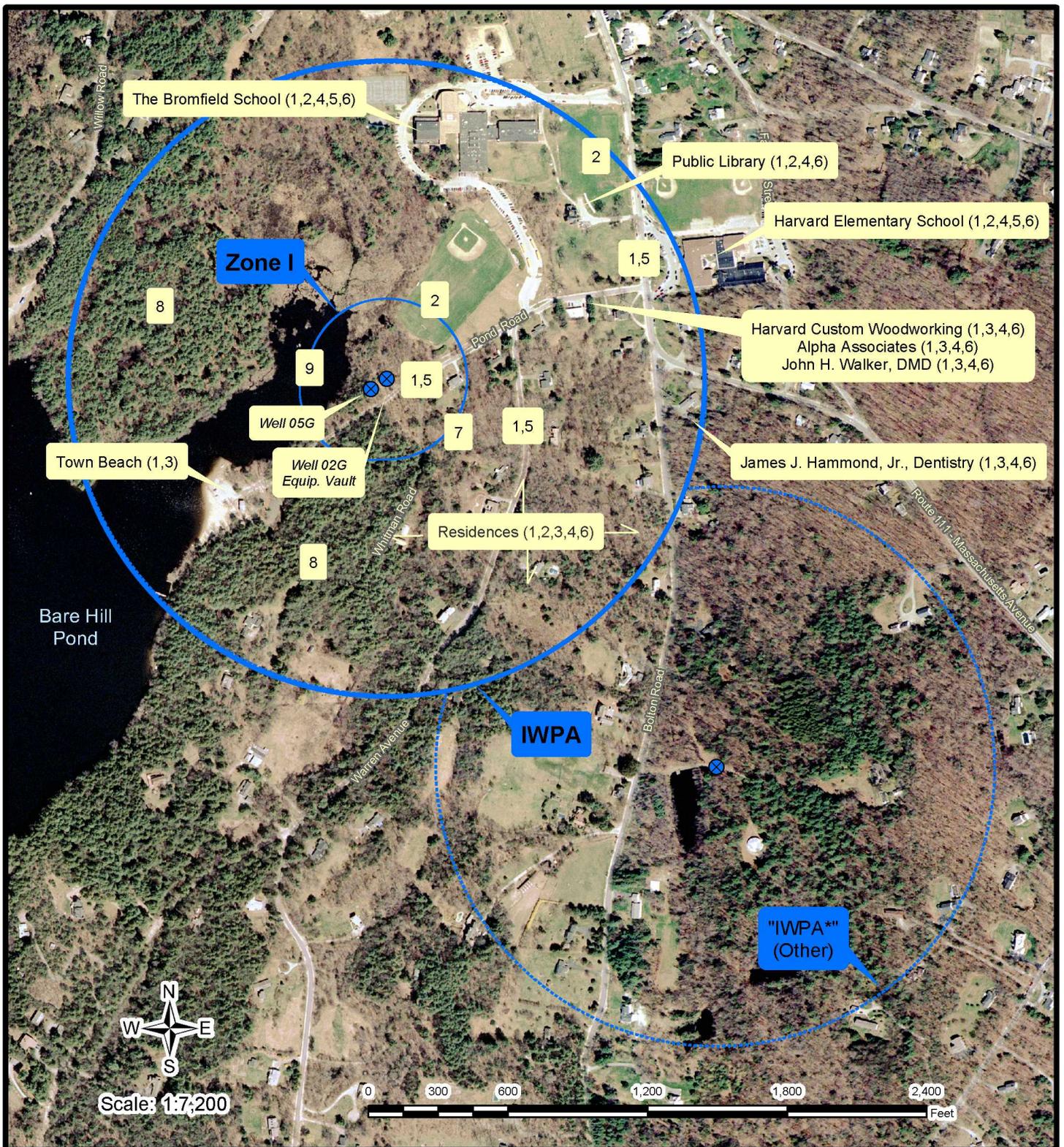
Public Education/Outreach: Action items focused on public education and outreach are itemized above.

Schedule: An exact schedule is not proposed because the recommendation list is long, implementation is voluntary and the Town's material and financial resources for such efforts may be quite limited. However, short-term and long-term timeframes are specified for each of the recommendations outlined above. Urgent or relatively low-cost and less labor-intensive recommendations should be implemented as soon as possible. Less urgent, more expensive or more time-consuming ideas are suggested for long-term implementation, as resources allow.

Contact: For more information, consult the comprehensive SPP or contact the Harvard Water Department at (978) 456-4130. The Mass Rural Water Association may be reached at (866) 451-8099.

Reference: *Comprehensive Source Protection Plan, Pond Road and Bolton Road Wells, Harvard, Massachusetts, PWS ID No. 2125000* (Mass Rural Water Association, June 2006).

Revision Date: July 2006.



Legend

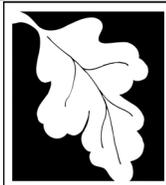
-  Public Water Supply Well - HWD
-  Potential Source of Contamination (PSOC) / Land Use
(see text for PSOC and land use descriptions)

Source Protection Plan
SOURCE PROTECTION AREA
 Wells #2 & #5, Pond Road, Harvard, MA
 PWS ID# 2125000-02G & -05G

Author: MAH
 Date: 06/06



Source(s): MassGIS Color Digital Orthophoto Images 193914 & 197914, 04/01
 MassGIS PWS Datalayer, 06/05; Locations of Wells #2/#5 adjusted based on field data.
 *See text re: HWD IWPA delineation/estimation.



Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program
Wellhead Protection Plan Checklist
Guidelines for Small Systems (sources pumping <100,000gpd)

Developing a Wellhead Protection Plan (WHPP) is integral to ensuring a good clean drinking water supply. Key components of an approved WHPP include: Establishing a protection committee/team - Defining the wellhead protection area - Identifying potential sources of contamination - Protecting and managing the wellhead protection area, and - Conducting ongoing public education and outreach.

This checklist can be used to ensure your plan meets DEP guidelines. If you would like to be notified of developing an approved Wellhead Protection Plan, please complete and submit this form to DEP's Drinking Water Program in Boston. For assistance in developing a WHPP, see DEP's guidance document 'Developing a Local Wellhead Protection Plan' at the Program's web site: <http://www.mass.gov/dep/brp/dws>.

System Name: Harvard Water Department

PWS ID#: 2125000

Municipality: Harvard, MA

Wells (01G, 02G etc): 03G

- ✓ **The plan identifies the wellhead protection committee/team members - a committee or team can consist of the water supplier and certified operator.**
- ✓ **The plan includes a current map of the Zone I/IWPA that shows (or lists) the current land uses - conduct an inspection and locate the land uses on your Zone I/IWPA map; or, refer to your SWAP Report/map or most recent DEP site exam report.**
- ✓ **The plan describes the existing protection measures in place – include all measures that currently protect the water supply, i.e. posted protection signs; fencing; Zone I inspections; land purchases; conservation restrictions; land owner agreements; threats (UST, septic) removed from Zone I/IWPA; drainage improvements; Best Management Practices; secondary containment installed; or municipal bylaws/health regulations that include the Zone I/IWPA.**
- ✓ **The plan identifies potential threats to the water supply and the protection strategies to address them - See list above for protection strategies.**
- ✓ **The plan includes public education/outreach – such as providing source protection informational material or notification letters to land owners in the Zone I/IWPA, or posting signs in facilities located in the Zone I.**
- ✓ **The plan includes a timeline (schedule) for accomplishing the identified protection strategies - For example;**
 1. Remove septic system from Zone I- June 2005
 2. Fence pump house – September 2005

Improve drainage around wellhead – March 2006

Sign:

Date:

ABBREVIATED SOURCE PROTECTION PLAN

PWS ID# 2125000, WELL #03G – HARVARD WATER DEPARTMENT, HARVARD, MA

Source Protection Committee: The committee for the Harvard Water Department (HWD) currently consists of Water Commissioners Dave Swain, Duane Barber and Ron Ricci as well as Department of Public Works Director Richard Nota and Foreman/Operator Ron Gilbert.

Inspection & Land Use Map: A source protection area (SPA) inspection was completed on October 27, 2005. An official SPA for Well #3 has not been delineated because it is an emergency source. The SPA was estimated prior to the inspection using the well's maximum pump capacity and standard equations for interim SPA determination in Massachusetts. Physical land features, potential sources of contamination (PSOCs) identified during the inspection and subsequent research, land use designations, and property boundaries within the SPA are shown in Appendix A of the comprehensive source protection plan (SPP). Land uses are summarized on the attached map.

Existing Protection Measures: In addition to requesting the comprehensive SPP, the Town has actively sought to implement protection measures at their facilities including:

- Regularly *inspecting* the SPAs and maintaining *neat, sanitary* facilities;
- Installing a PWS *sign* and locking *gate/doors* at Pond Road;
- Periodically *cleaning* the water storage tank and assessing *cross-connections*;
- Investigating preventive chlorine *disinfection* options;
- Pursuing additional groundwater *sources*;
- Adding an experienced *manager* and new *operator* to the HWD staff;
- Enlisting experienced *volunteer* assistance with capacity improvement;
- Aggressively pursuing sanitary survey requirements *and* recommendations;
- Investing in a custom *telemetry* system and *main replacement* program; and
- Incorporating potential *security improvements* for the Bolton Road pump house access road into a proposed utility project.

The Town has also proactively promoted other projects designed to improve groundwater protection such as:

- Conveying *sewage* from the schools/library outside of the SPAs;
- Completing a *wastewater district* feasibility study which includes Pond Road;
- Enhancing nutrient removal thru *innovative* technology at the wastewater treatment plant (WWTP);
- Minimizing *road salt* usage;
- Avoiding outdoor *pesticide* use at the schools; and
- Timely, comprehensive *cleanup* of the oil spill at The Bromfield School.

Potential Threats & Protection Strategies: Potential threats to this water supply include at least eight PSOCs. PSOCs are identified on the attached map and include:

<u>PSOC ID. #</u>	<u>Potential Threat</u>	<u>Threat Ranking</u>
1	Parking Areas & Roads	Moderate-High
2	Lawns & Fields	Moderate
3	Sanitary Waste	Moderate-High
4	Hazardous Materials & Waste	Low-Moderate
5	Electrical Distribution Equipment	Low-Moderate
6	Petroleum Storage Systems	Moderate-High
7	Animal Waste	Low
8	Forestry	Low

Other issues relevant to the protection of this water supply include: System Maintenance, Well Yield Protection, System Security, Sanitary Survey/SWAP Report Follow-up, Future Land Uses & Regulatory Controls, Additional Water Quality Testing, Preventive Monitoring, Public Education and Other Water Supply Wells.

Based on a review of the potential threats and other issues relevant to the protection of this water supply, a number of specific regulatory and non-regulatory (including best management practices or BMPs) action items are suggested. More information on each action item, including detailed descriptions of related threats and links to helpful resources, is provided in the comprehensive SPP.

Acronyms listed below are identified in the comprehensive SPP. The suggested action items (or protection measures) are:

SUGGESTIONS FOR TOWN PROPERTIES

Short-Term

- Train/equip (as needed) staff to handle *accidental chemical spills* near the wells.
- Continue to minimize *road salt* use; plow snow away from Zone I if possible.
- Monitor *parking areas/roads* and quickly clean up motor fluid *spills*.
- Notify applicable *Town boards/staff* (including DPW, fire, school, library, beach, conservation, planning and pond officials) about the SPAs and BMPs; submit a copy of this SPP to the Town Clerk.
- Continue to avoid the use of *pesticides* at the school fields; carefully manage the application of *fertilizers*, if any.
- Review *water testing results*, if any, for the stream near the wells, and support *water quality studies* by groups such as NRWA/BHPWMC.
- Consider posting *notices* or *warning signs* at each Town facility regarding chemical spill, HHW, septic system and pet waste BMPs.
- Continue to maintain, monitor and document *WWTP operations*.
- Encourage the use of *non-hazardous* materials and properly store and manage all *hazardous* materials/waste.
- Inspect Town facilities for *floor drains* with the potential to pollute the ground; remove or repair as needed.
- Assess the condition and fluid PCB-content of *transformers* in the SPAs.
- Monitor and maintain *petroleum systems* in accordance with applicable rules and BMPs; discuss *spill response* issues with Town site managers/oil suppliers as needed and consider developing a *tank inventory/inspection file*.
- Continue to routinely *inspect* the SPAs and *maintain* water system equipment.
- Evaluate the need for an air gap on the *dehumidifier drain* at Well #2.
- Continue to routinely clean and inspect the *water storage tank*.
- Budget for long-term *equipment replacement* and *source protection* costs.
- Check the condition of the equipment vault *drain pipe outlet* at Well #2 and *wellhead cap/sanitary seal* at Well #3; repair if needed.
- Notify DEP of *well location corrections* and verify map location of Well #3.
- Consider posting a drinking water supply *sign* near Well #3 and continue to negotiate for a *locked gate* on the Well #3 access road.
- Submit this *SPP* to DEP to satisfy their sanitary survey recommendation.
- Evaluate the need to collect a water sample from Well #3 for *arsenic* analysis.

- Hold regular source protection *meetings*.
- Assess the system's level of readiness for *contingencies* and *emergencies* as described in Section 6.0.

Long-Term

- Evaluate the feasibility of modifying road areas to improve *Zone I compliance*.
- Monitor, map and maintain *storm drains* and encourage LID practices.
- Continue to explore the possibility of *expanding* sewer service.
- Install a modern *septic system* or provide a *sewer hookup* at the Town Beach.
- Replace or test the *fuel oil UST* at The Bromfield School; consider *ASTs* or *alternative heating fuels* at Town facilities in the SPAs.
- If *logging* is anticipated, follow the state's BMPs for water resource protection.
- Support the use of *non-chemical weed management* at Bare Hill Pond; follow applicable BMPs if *herbicides* must be used.
- Complete regular *leak surveys* and encourage *water conservation*.
- Routinely check for *cross-connections* and *share* the results with customers; encourage the use of *hose bibbs* by HWD customers.
- Prepare water *distribution system maps* as needed.
- Consider creating a routine pump/pump column/well casing *inspection program*.
- Consider periodically *exercising* and inspecting Well #3 to maintain operability.
- Consider adding *water level* monitoring to routine system operations.
- Consider installing protective *barriers* at Wells #2 (equipment vault) and #3.
- Avoid further *development* of Town properties in the SPAs.
- Continue to address *SWAP report* and *sanitary survey* issues as needed.
- Periodically evaluate *long-term trends* in water quality, level and yield.
- Promote *groundwater education* at the schools and library.

SUGGESTIONS FOR OTHER PROPERTIES

Short-Term

- Notify SPA *residents, businesses* and *state officials* about the SPAs and BMPs.
- Evaluate the feasibility of designating Route 111 as a *Reduced Salt Area* and encourage the state to use alternative salt management strategies.
- Investigate the condition/PCB content of *transformers* on Route 111.
- Encourage *SPA residents* to follow HHW, pesticide/fertilizer, septic system, heating oil and pet waste BMPs.
- Request chemical storage, waste handling and compliance information from the *dental offices* and *woodworking facility*.
- Specify *LID/conservation design* practices in the site permitting process.
- Develop and adopt *aquifer and watershed protection bylaws* to improve groundwater protection and include all SPAs on associated maps.
- Promote aquifer protection by hosting a *field trip* and/or creating a *brochure*.
- Encourage source protection *committee membership*.

Long-Term

- Consider completing petroleum storage tank and/or septic system *surveys*.

- Consider contacting other *local PWSs* about common aquifer protection concerns and encouraging them to develop or update SPPs.
- Support *local boards* implementing the MP, OSRP and TCAP.
- As needed, contact *local conservation groups* to assess land purchase/easement options in/near the SPAs or partnerships for conservation/education projects.
- Encourage local officials to amend *zoning/general bylaws* and *subdivision/health regulations* as needed to further improve groundwater protection, including the adoption of floor drain requirements and updated earth excavation laws.

Methods of emergency monitoring and incident preparation, including contingency planning for alternative sources of water, are also discussed in the comprehensive SPP. The resulting recommendations are:

- Periodically *test* incident documentation/identification, response team activation and notification procedures.
- *Meet* with local fire, police and emergency management teams.
- Assess the sufficiency of *ERP directory*; maintain and regularly review/update the *ERP* as needed.
- Implement the source protection *recommendations* provided in Section 5.0.
- Maintain or develop *agreements* with bottled/bulk water suppliers, local contractors, equipment suppliers and hazardous waste disposal firms.
- Develop *agreements* with treatment service providers, an LSP and a water supply engineer, if not already completed.
- Maintain a *list* of contractors, suppliers, treatment firms and consultants.
- *Post* emergency contact and startup/shutdown procedures in accessible areas.
- Assess system *readiness* for emergency generators.
- Consider periodically *exercising* and inspecting Well #3 to maintain operability.
- Evaluate and select the most feasible *standby chlorination* option.
- Select a *backup* short-term contingency option for non-bacterial incidents.
- Identify long-term source options for *worst-case scenarios*, including completion of further studies at the 1996 test well.
- Consider completing a modern town-wide groundwater *exploration study*, including an evaluation of potential improvements to Well #3.
- Research and *budget* for short-term and long-term contingencies.

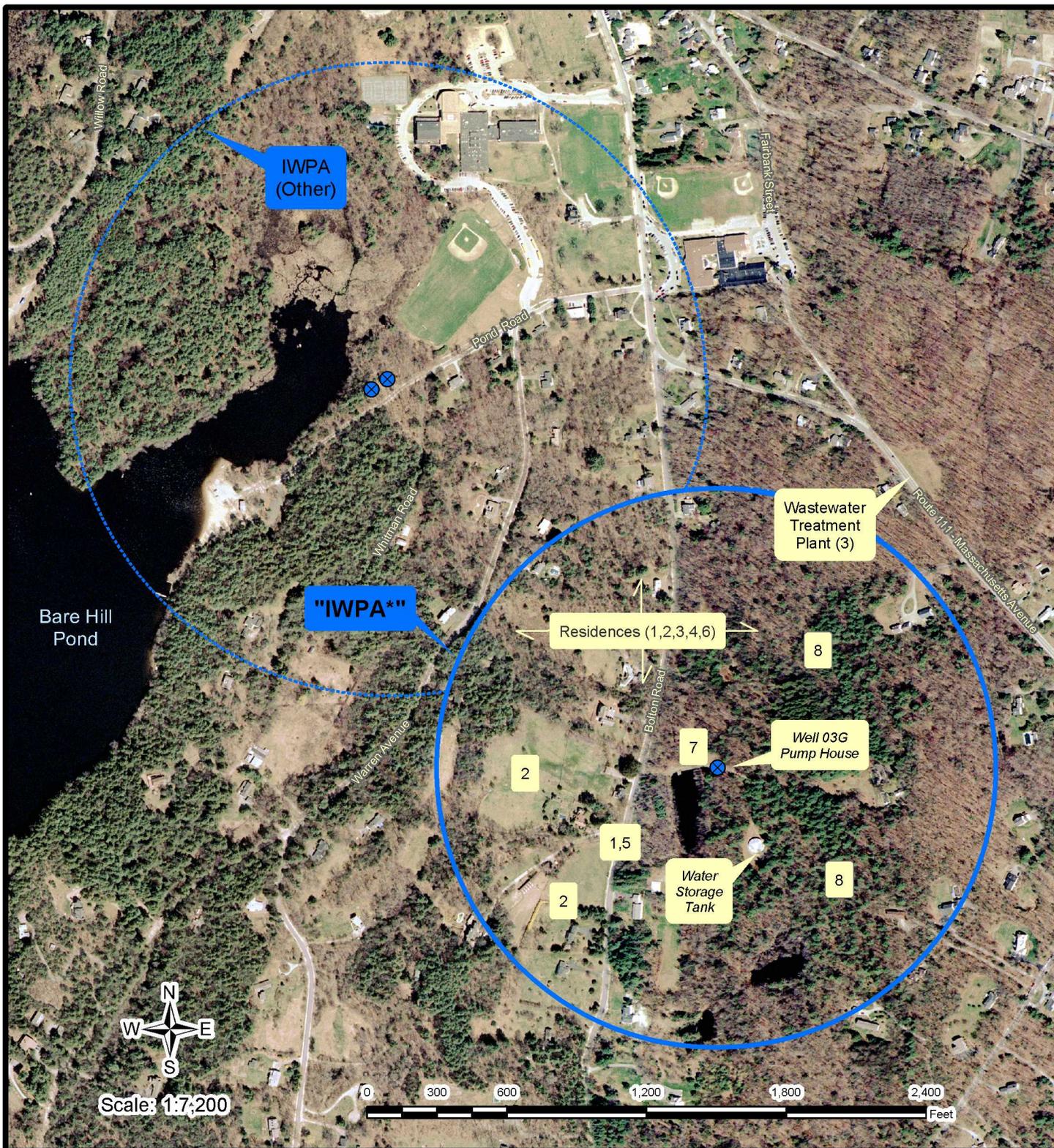
Public Education/Outreach: Action items focused on public education and outreach are itemized above.

Schedule: An exact schedule is not proposed because the recommendation list is long, implementation is voluntary and the Town's material and financial resources for such efforts may be quite limited. However, short-term and long-term timeframes are specified for each of the recommendations outlined above. Urgent or relatively low-cost and less labor-intensive recommendations should be implemented as soon as possible. Less urgent, more expensive or more time-consuming ideas are suggested for long-term implementation, as resources allow.

Contact: For more information, consult the comprehensive SPP or contact the Harvard Water Department at (978) 456-4130. The Mass Rural Water Association may be reached at (866) 451-8099.

Reference: *Comprehensive Source Protection Plan, Pond Road and Bolton Road Wells, Harvard, Massachusetts, PWS ID No. 2125000* (Mass Rural Water Association, June 2006).

Revision Date: July 2006.



Legend

-  Public Water Supply Well - HWD
-  Potential Source of Contamination (PSOC) / Land Use
(see text for PSOC and land use descriptions)

Source Protection Plan
SOURCE PROTECTION AREA
 Well #3, Bolton Road, Harvard, MA
 PWS ID# 2125000-03G

Author: MAH
 Date: 06/06



Source(s): MassGIS Color Digital Orthophoto Images 193914 & 197914, 04/01
 MassGIS PWS Datalayer, 06/05; Locations of Wells #2/#5 adjusted based on field data.
 *See text re: HWD IWPA delineation/estimation.

APPENDIX D

**LANDOWNER LIST, EXAMPLE NOTIFICATION LETTERS & EXAMPLE
INDOOR POSTING**

List of Landowners Within the IWPA¹
Pond Road and Bolton Road Wells, Harvard Water Department
Harvard, MA

<u>IWPA²</u>	<u>Parcel ID³</u>	<u>Street No.</u>	<u>Street</u>	<u>LUC⁴</u>	<u>Acres</u>	<u>Owner1/Owner2</u>	<u>Mailing Address</u>	<u>Heat Fuel</u>
02G+05G	17C-1.2	----	Still River Road	903	2.55	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	17C-2	15	Still River Road	906	2.79	Roman Catholic Bishop of Worcester	P.O. Box 746, Harvard, MA 01451	"Typical"
02G+05G	17C-3.2.1	----	Still River Road	903	16.10	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	17C-3.2.2	----	Still River Road	132	0.73	Harvard Conservation Trust Development	C/O Audrey Ball, P.O. Box 31, Harvard, MA 01451	----
02G+05G	17C-4	23	Still River Road	101	2.50	Josephine M. Barba	P.O. Box 291, Harvard, MA 01451	Gas
02G+05G	22-60.1	----	Warren Avenue	905	1.71	Harvard Conservation Trust	C/O Audrey Ball, P.O. Box 31, Harvard, MA 01451	----
02G+05G	22-61	----	Whitman Road	106	4.46	Peter T. & Sharon L. Pick	C/O Morey R. & Tracy F. Kraus, 30 Whitman Road, Harvard, MA 01451	----
02G+05G	22-62	20	Warren Avenue	101	2.00	Stephen F. & Daphne H. Cassin	20 Warren Avenue, Harvard, MA 01451	Gas
02G+05G	22-63	32	Whitman Road	101	2.16	Edmund A. & Gertrude E. Ortler	P.O. Box 323, Harvard, MA 01451	Oil
02G+05G	22-64	30	Whitman Road	101	4.84	Peter T. & Sharon L. Pick	C/O Morey R. & Tracy F. Kraus, 30 Whitman Road, Harvard, MA 01451	Oil
02G+05G	22A-1	16	Warren Avenue	101	3.19	James L. & J. Marcia Croyle	P.O. Box 706, Harvard, MA 01451	Oil
02G+05G	22A-2	10	Warren Avenue	101	1.22	Darren J. & Wendy C. Magan	10 Warren Avenue, Harvard, MA 01451	Gas
02G+05G	22A-3	----	Whitman Road	132	1.00	Walter F. Dickson, Jr.	28 Litchfield Pines Drive, Leominster, MA 01453	----
02G+05G	22A-4	15	Pond Road	101	1.00	William & Margaret L. Kilpi	15 Pond Road, Harvard, MA 01451	Oil
02G+05G	22A-5	19	Pond Road	101	1.30	Margaret A. Grogan & Mark Bierbower	P.O. Box 157, Harvard, MA 01451	Oil
02G+05G	22A-6	13	Whitman Road	101	1.30	Jonathan C. & Judith Williams	P.O. Box 546, Harvard, MA 01451	Electric
02G+05G	22A-7	----	Whitman Road	132	1.27	Jonathan C. & Judith Williams	P.O. Box 546, Harvard, MA 01451	----
02G+05G	22A-8	----	Whitman Road	903	2.91	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-9	----	Whitman Road	903	1.51	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-10	----	Whitman Road	903	1.25	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-11	----	Pond Road	903	1.16	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-12	----	Pond Road	903	1.06	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-13	----	Pond Road	903	1.28	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-14	----	Pond Road	903	8.27	Town of Harvard	13 Ayer Road, Harvard, MA 01451	"No Central"
02G+05G	22A-15	----	Pond Road	903	0.90	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-16	----	Pond Road	903	1.12	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-17	----	Pond Road	903	21.00	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22A-34.1	----	Willow Road	601	15.73	Harvard Conservation Trust Development	C/O Audrey Ball, P.O. Box 31, Harvard, MA 01451	----
02G+05G	22A-36	----	Pond Road	903	7.38	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----

02G+05G	22B-20	----	Massachusetts Avenue	903	0.04	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
02G+05G	22B-21	40	Massachusetts Avenue	031	1.87	Hammond Bros. LP; James J., Jr. & John F. Hammond	P.O. Box 704, Harvard, MA 01451	Oil
02G+05G	22B-22	----	Bolton Road	132	1.40	George A., Jr. & Beth E. Hill	100 Newbury Court, Unit 303, Concord, MA 01742	----
02G+05G	22B-29	10	Bolton Road	101	0.87	Alexander G. MacLennan	P.O. Box 336, Harvard, MA 01451	Gas
02G+05G	22B-30	4	Bolton Road	101	3.30	Thomas H. & Colleen Pearce Payne	C/O Colleen P. Payne, 4 Bolton Road, Harvard, MA 01451	Gas
02G+05G	22B-31	36	Massachusetts Avenue	101	1.13	Henry J. & Nancy A. Park	36 Massachusetts Avenue, Harvard, MA 01451	Oil
02G+05G	22B-32	32	Massachusetts Avenue	101	0.75	Gentry O. & Dinah S. Deck	32 Massachusetts Avenue, Harvard, MA 01451	Oil
02G+05G	22B-34	9	Pond Road	101	0.97	Douglas A. Wiles	9 Pond Road, Harvard, MA 01451	Oil
02G+05G	22B-35	5	Warren Avenue	101	1.00	Robby L. & Kaye S. Ward	5 Warren Avenue, Harvard, MA 01451	Oil
02G+05G	22B-36	9	Warren Avenue	101	1.50	Lois G. Gilmore Realty Trust	4 Simon Atherton Row, Harvard, MA 01451	Oil
02G+05G	22B-40	24	Massachusetts Avenue	905	6.80	Bromfield Trustees; James A. Dunlap, Jr.	P.O. Box 637, Harvard, MA 01451	Oil
02G+05G	22B-42	27	Massachusetts Avenue	903	6.50	Town of Harvard	13 Ayer Road, Harvard, MA 01451	Oil
02G+05G	22B-43	39	Massachusetts Avenue	903	1.90	Town of Harvard	13 Ayer Road, Harvard, MA 01451	Oil
02G+05G	22B-1033	5	Pond Road	340	0.00	Mahogany Run Realty Trust I; Wendell W. Willard & Donald E. Wasiuk	P.O. Box 517, Harvard, MA 01451	Oil
02G+05G	22B-2033	5	Pond Road	340	0.00	Mahogany Run Realty Trust II; Karen L. Harding	P.O. Box 120, Harvard, MA 01451	Oil
02G+05G	22B-3033	5	Pond Road	340	0.00	Mahogany Run Realty Trust III; John H. & Cynthia F. Walker	119 Massachusetts Avenue, Harvard, MA 01451	Oil
02G+03G+05G	22-38	26	Bolton Road	101	2.47	Harry M. & Joyce A. Jacobson	26 Bolton Road, Harvard, MA 01451	Oil
02G+03G+05G	22-39	----	Bolton Road	130	2.00	William T. Hazel	150 Ayer Road, Harvard, MA 01451	----
02G+03G+05G	22-40	----	Warren Avenue	132	2.37	Harry M. & Joyce A. Jacobson	26 Bolton Road, Harvard, MA 01451	----
02G+03G+05G	22-41	25	Warren Avenue	101	2.50	Donald Bert Strang Trust	C/O Donald Bert Strang, Trustee, P.O. Box 531, Harvard, MA 01451	Oil
02G+03G+05G	22-42	27	Warren Avenue	101	3.13	Eugene & Patricia A. Graham	P.O. Box 489, Harvard, MA 01451	Oil
02G+03G+05G	22B-24	13	Bolton Road	109	3.15	Edward A. & Diane E. Pieters	13 Bolton Road, Harvard, MA 01451	Gas
02G+03G+05G	22B-26	20	Bolton Road	101	1.40	William T. Hazel	150 Ayer Road, Harvard, MA 01451	Oil
02G+03G+05G	22B-27	----	Bolton Road	132	0.20	Alexander G. MacLennan	P.O. Box 336, Harvard, MA 01451	----
02G+03G+05G	22B-28	----	Bolton Road	130	1.35	Alexander G. MacLennan, Jr.	P.O. Box 336, Harvard, MA 01451	----
02G+03G+05G	22B-37	----	Warren Avenue	130	1.45	Carol S. MacLennon	P.O. Box 336, Harvard, MA 01451	----
02G+03G+05G	22B-38	17	Warren Avenue	101	1.43	Royall D. & Sandra Cregar	17 Warren Avenue, Harvard, MA 01451	Oil
02G+03G+05G	22B-39	19	Warren Avenue	101	1.00	Greene Realty Trust; Donna M. Green	19 Warren Avenue, Harvard, MA 01451	Electric
03G	22-9	92	Slough Road	101	4.68	David & Mary Ellen Broganer	92 Slough Road, Harvard, MA 01451	Oil
03G	22-10	82	Slough Road	101	3.02	Stephen R. Jenkins & Claudia Kopkowski	82 Slough Road, Harvard, MA 01451	Oil
03G	22-13	84	Slough Road	101	2.68	Steven A. & Elizabeth G. Kendall	84 Slough Road, Harvard, MA 01451	Oil
03G	22-14	80	Slough Road	101	2.52	80 Slough Road Trust	C/O Laura E., 80 Slough Road, Harvard, MA 01451	Oil
03G	22-16	72	Slough Road	101	2.19	Linda A. Moore	72 Slough Road, Harvard, MA 01451	Oil
03G	22-17	70	Slough Road	101	2.50	John V. & Joan Accorsi	70 Slough Road, Harvard, MA 01451	Oil

03G	22-20.1	86	Massachusetts Avenue	101	2.39	Carlton E. Nichols, Jr.	P.O. Box 260, Harvard, MA 01451	Oil
03G	22-21	72	Massachusetts Avenue	101	30.91	Ronald M. & Marian J. Getty	72 Massachusetts Avenue, Harvard, MA 01451	Oil
03G	22-24	21	Bolton Road	101	3.38	Curtis W. Howes	21 Bolton Road, Harvard, MA 01451	Oil
03G	22-25	----	Bolton Road	903	16.00	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
03G	22-26	----	Bolton Road	903	0.78	Town of Harvard	13 Ayer Road, Harvard, MA 01451	----
03G	22-27	47	Bolton Road	101	4.40	Gilbert A., Jr. & Jayne E. Smith	47 Bolton Road, Harvard, MA 01451	Oil
03G	22-29	58	Bolton Road	101	1.90	Greta Schmidt Estate	C/O Alice L. Schmidt, P.O. Box 314, Harvard, MA 01451	Oil
03G	22-31	52	Bolton Road	101	2.15	Stephen A. & Joan E. Burns	52 Bolton Road, Harvard, MA 01451	Oil
03G	22-32	50	Bolton Road	101	1.55	Esselstyn Investment Trust	50 Bolton Road, Harvard, MA 01451	Oil
03G	22-34	42	Bolton Road	109	12.56	Donna Conklin	42 Bolton Road, Harvard, MA 01451	Gas
03G	22-35	40	Bolton Road	101	4.80	Robert W. & Joan Dillard	P.O. Box 496, Harvard, MA 01451	Gas
03G	22-36	36	Bolton Road	101	1.75	Leslie Ekings & James A. Kinney	36 Bolton Road, Harvard, MA 01451	Oil
03G	22-37	30	Bolton Road	101	1.87	Muzyka Nominee Realty Trust; Paul G. & Cynthia D. Muzyka	P.O. Box 742, Harvard, MA 01451	Oil
03G	22-43	33	Warren Avenue	101	2.17	Beverly R. & Kevin Jorgensen	P.O. Box 104, Still River, MA 01467	Oil
03G	22-44	41	Warren Avenue	101	3.26	Ronald & Susan C. Ostberg	41 Warren Avenue, Harvard, MA 01451	Oil
03G	22B-14	70	Massachusetts Avenue	101	3.05	Michael J. Egan	70 Massachusetts Avenue, Harvard, MA 01451	Oil
03G	22B-15	64	Massachusetts Avenue	101	0.66	Arthur W. & Frances M. Callbeck	P.O. Box 203, Harvard, MA 01451	Oil
03G	22B-16	62	Massachusetts Avenue	101	2.06	Justin R. & Mary Jane Fallon	P.O. Box 266, Harvard, MA 01451	Oil
03G	22B-17	54	Massachusetts Avenue	101	1.79	Margaret R. Lorentz	P.O. Box 191, Harvard, MA 01451	Oil
03G	22B-25	----	Bolton Road	905	2.66	Harvard Conservation Trust	C/O Audrey Ball, P.O. Box 31, Harvard, MA 01451	----
03G	27-71.2	71	Bolton Road	101	7.45	William C. & Marilyn S. Clark	C/O Douglas A. & Sheila Theriault, P.O. Box 109, Harvard, MA 01451	Gas

Notes: (1) Parcel data were obtained from Harvard Assessor's online database on 06/21/06.

(2) An IWPA radius of 1,200 feet was assumed for Well 03G, which is not required to have an IWPA delineation because it is an emergency source.

(3) Parcel ID #s = Map-Lot.

(4) Land Use Codes (LUCs) are described in Appendix B and identified in *Property Type Classification Codes* (MA Department of Revenue, November 2002).

EXAMPLE #1: LANDOWNER NOTIFICATION LETTER

(Water System Letterhead)

(Date)

Dear *(Landowner/Tenant)*:

The water system for *(System Name)* is serviced by *(# and type of wells)* that is/are located *(describe location)*. To proactively protect the quality and quantity of this drinking water source, we recently developed a Source Protection Plan. As part of the plan, we examined land uses and potential sources of contamination within the land area that contributes water to our well(s). We are sending this letter to all landowners whose property is within or near that area.

Land use activities that could occur on your property have the ability to negatively impact our water source. These activities may include: Improper disposal of household hazardous waste (“HHW” - paints, cleaners, etc.) and trash, spillage of motor oil and gasoline, misuse of septic systems or sewers, overuse of fertilizers and pesticides, heating fuel spills, concentrated storage/application of animal manure, etc.

Many of the negative impacts associated with these activities can be avoided with good management. For example, septic systems and sewers are not designed to treat HHW. Instead, this waste should be disposed of at a local or regional HHW Collection Day.

Fact sheets are enclosed that describe best management practices for *(septic systems, heating oil systems, manure storage, etc.)* We are asking you to do your best to minimize the release of contaminants which could threaten our water supply. We are also asking you to do your best to use water wisely and conservatively, particularly during dry periods, to ensure that our shared water resource is not depleted.

Please feel free to contact me at *(your phone #)* for more information. Copies of the Source Protection Plan are available for review at *(your office, etc.)*. Thank you for your cooperation in keeping our drinking water safe.

Sincerely,

(Name)

(Water System Operator or Responsible Person)

Encl. Source Protection Area Map(s) *(attach Figures as appropriate)*
Best Management Practices Fact Sheets *(download/attach as appropriate - see text)*

EXAMPLE #2: LANDOWNER NOTIFICATION LETTER

[This letter has been adapted from an example provided by DEP (February 14, 2003). To be effective, the letter should address issues specific to your situation. When writing to a business, it is important to tailor the letter, recommendations and enclosed material to that business.]

(Water System Letterhead)

(Date)

Dear *(Resident/Business)*:

I am writing to advise you of the location of the *(name of public water supply system)* which serves *(number of people)*. Your property is located in or near the area from which water flows to the system's well(s), and this area needs protection from land uses that threaten the well(s).

Groundwater comes from rain and snowmelt percolating through the ground, flowing through spaces between soil particles and fractures in rock. Groundwater is vulnerable to contamination from many types of land uses and activities, including road salt, septic systems, and improper disposal of hazardous materials. If the groundwater becomes contaminated, it may be impossible to eliminate the contamination so that the well can continue to be used for drinking water.

I am contacting you to request your assistance and cooperation in protecting this supply. There are a number of ways in which you can help reduce the possibility of contamination of the well(s). For example:

- If your house/business is served by a **septic system**: Pump out the tank every two to three years; do not use commercial septic tank cleaners or put hazardous materials down the sink, toilet or floor drain.
- If your house/business uses **heating oil**: Check for leaks; remove underground storage tanks; install secondary tank containment/protection; use a vent alarm.
- Avoid applying **hazardous or toxic materials** to lawns or other areas of your property. Never dispose of used motor oil or other hazardous materials in storm sewers.

Enclosed *is/are* fact sheet(s) which I urge you to read. If you have any questions, please contact *(your name and phone number)* or the state's Drinking Water Program at (617) 292-5770.

The management and customers of the *(name of community served)* appreciate your cooperation in protecting this important source of drinking water.

Sincerely,

(Name)

(Water System Operator or Responsible Person)

Encl. Fact Sheet(s) *(download/attach as appropriate - see text)*

EXAMPLE INDOOR POSTING

(For posting notices to staff, students and visitors at Town facilities in the SPAs. This sample has been adapted from one provided by DEP (February 14, 2003) for you to copy and place in any common areas, including kitchens, bathrooms, parking lots and/or maintenance rooms - especially those with sinks and/or floor drains.)

****PROTECT YOUR DRINKING WATER!**

You are located in a Water Supply Protection Area. Please:

- Don't use, store or dispose of toxic/hazardous materials/wastes in this area or on the ground. Immediately notify staff of any motor vehicle fluid or chemical spills.
- Don't put hazardous materials (*paint, thinner, cleaning products, pesticides, waste oil, etc.*) or materials that will clog pipes (*grease, oil, fat, diapers, rags, bandages, personal hygiene products, etc.*) down any sink, toilet or floor drain.
- Bring leftover/waste hazardous chemicals to a household hazardous waste collection center or to this facility's hazardous waste storage area.
- Use less toxic or non-toxic materials if available.
- Clean up after your pets. Pick up and properly dispose of trash.

*****To get more information or report suspicious activities, please contact the water supplier at () - or MA DEP's Drinking Water Program at (617) 292-5770.***

APPENDIX E

OFFICIALS LIST & EXAMPLE NOTIFICATION LETTER

LIST OF LOCAL, STATE & REGIONAL AGENCIES

<i>Submit copy of Source Protection Plan to:</i>	
Ms. Janet Vellante, Town Clerk Town of Harvard* 13 Ayer Road, Town Hall Harvard, MA 01451	Ms. Josephine Yemoh-Ndi MA Dept. of Environmental Protection 627 Main Street Worcester, MA 01605
<i>Submit notification letter and map(s) to:</i>	
Ms. Elizabeth Ainsley Campbell Nashua River Watershed Association 592 Main Street Groton, MA 01450	Ms. Laila Michaud Montachusett Regional Planning Commission R1427 Water Street Fitchburg, MA 01420
District Highway Director MA Highway Department 403 Belmont St. Worcester, MA 01604	Mr. Ronald E. Thompson USDA Natural Resources Conservation Svc. 52 Boyden Road, Room 10 Holden, MA 01520-2587
District Administrator Worcester County Conservation District 52 Boyden Road, Room 100 Holden, MA 01520-2587	Mr. Victor Normand Harvard Conservation Trust P.O. Box 31 Harvard, MA 01451

*Note: A copy of the Source Protection Plan (SPP) should be sent to the Town Clerk so that applicable Town agencies will all have access to the SPP. A notification letter and map(s) should be sent to the Town agencies listed below (all contacts are located at the Town Office address shown above unless otherwise indicated):

<i>Agency:</i>	<i>Contact:</i>
Planning Board	Mary Essary, Chair
Zoning Board of Appeals	Marc LaCasse, Chair
Board of Health	Shanna Large, Admin. Assistant
Health Agent	Ira Grossman, Agent (Nashoba Assoc. Bds. of Health, 30 Central Ave., Ayer, MA 01432)
Building Inspector	Gabrielle Vellante, Jr., Inspector
Conservation Commission	Paul Willard, Chair
Fire Department	Robert Mignard, Chief
Police Department	Edward Denmark, Chief (40 Ayer Road)
Emergency Mgmt. Director	Robert Mignard, Director
Public Works Department	Richard Nota, Superintendent
Town Center Planning Comm.	Tim Clark, Chair
Bare Hill Pd. Water. Mgmt. Com.	Bruce Leicher, Chair
School Committee	Mihran Keoseian, Superintendent

EXAMPLE OFFICIAL NOTIFICATION LETTER

(Water System Letterhead)

(Date)

Dear *(State, Local or Regional Official)*:

The public water system for *(System Name)* is serviced by *(# and type of wells)* that is/are located *(describe location)*. In an effort to proactively protect the quality and quantity of our drinking water source, we recently developed a Source Protection Plan. As part of this plan, we examined land uses and potential sources of contamination within the land area(s) that contribute(s) water to our well(s).

We are sending this letter to local, state and regional officials who make **land use** or **emergency** decisions in or near our recharge area(s). These decisions have the ability to negatively impact both the quality and quantity of our water source.

Commercial, industrial, agricultural, residential, municipal and institutional land uses have all been associated with groundwater degradation. Many of the negative impacts associated with these activities can be reduced by encouraging environmental protection through best management practices (BMPs) such as minimizing chemical usage. BMPs for “green” site design and development which limit impervious surface area and maximize water infiltration are also critical to maintaining sufficient quantities of good quality groundwater.

Emergency officials responding to acts of vandalism, fires, chemical spills, motor vehicle accidents, natural disasters, etc. can reduce groundwater degradation by simply being aware of our protection area(s) and identifying either damage to the well(s) or chemical seepage nearby. All chemical spills in or near the recharge area(s) should be immediately contained or diverted away from the well(s) in accordance with standard hazardous material response procedures.

Please assist us in protecting our valuable water supply by encouraging the use of appropriate BMPs/procedures, familiarizing yourself with our location, and contacting us during emergencies. Also, please consider updating your plans and regulations, if applicable, to reflect current state policies for groundwater protection in drinking water supply areas.

Copies of the Source Protection Plan are available for review at *(your office)* and the *(your town)* Town Hall. Thank you for your cooperation in keeping our drinking water safe.

Sincerely,

(Name)

(Water System Operator or Responsible Person)

Encl. Source Protection Area Map(s) *(attach Figures as appropriate)*

APPENDIX F

EMERGENCY RESPONSE INFORMATION

Emergency Response Checklist
Emergency Response Levels
Emergency Management & Public Health (MA) Fact Sheet
A Utility Guide for Security Decision Making

If Level I or II, stop and file the report at this point.

If Level III or greater, continue on.

Which of the following actions were involved in the emergency? (Check appropriate actions)

Motor vehicle accident:

Vehicle type: _____ Make: _____

Color: _____ Reg. _____ State: _____

Owner (Name/Address): _____

Accidental discharge:

Illegal dumping/discharge:

Chemical(s) involved:

Trade Name/ Common Name: _____

(Circle) Solid / Liquid / Vapor Other: _____

Placard / Label ID / DOT #: _____

Disease outbreak, type of disease: _____

Bacterial Problem, describe: _____

Nearest Public Drinking Water Source (surface/ground):

Name/address (location)

Approximate distance from emergency location _____

Which of the following actions did you complete? (Check appropriate actions)

Notify person(s) in charge of all emergencies:

Name: _____ Home

Telephone _____

Work Telephone _____

Initial Emergency Response: _____

Close reservoir: _____ Wells Nos. _____
Name of Reservoir

Shutdown pump(s): _____
No. or Name

Shut off some of the distribution lines
Specify (location, valve): _____

Cross Connection Survey
Results: _____

Other (describe): _____

Local Authorities/Departments Contacted:

<input type="checkbox"/> Water Supply Superintendent/Assistant	<input type="checkbox"/> Certified Operator
<input type="checkbox"/> Mayor/Officials	<input type="checkbox"/> Fire Department
<input type="checkbox"/> Police Department	<input type="checkbox"/> Health Department
<input type="checkbox"/> Other: _____	

Local/Regional News Media Contacted:

<input type="checkbox"/> Local Newspaper	<input type="checkbox"/> Local Radio Station
<input type="checkbox"/> Local TV Station	<input type="checkbox"/> Local Short-wave
<input type="checkbox"/> Other: _____	<input type="checkbox"/> Radio Operator(s)

State Authorities/Agencies Contacted:

State Police / State Agencies (Emergency Line)
 DEP (Emergency Line): Boston NERO SERO CERO WERO
 DEP: Water Pollution Control Hazardous Waste
 Department of Public Health
 Massachusetts Emergency Management Agency (MEMA)
 Other: _____

Federal Authorities/Agencies Contacted:

EPA - Boston Office (Emergency Line)
 National Response Center
 Coast Guard
 Federal Emergency Management Agency (FEMA)
 Federal Highway Administration
 National Guard
 Communicable Disease Center - Atlanta, GA
 Other: _____

Notify office staff about the problem/emergency to answer questions from the users;

Brief the person(s) in charge of the emergency response and superiors about new developments;

Prepare and attach a list of equipment and materials (specification/quantity) used in emergency response;

Emergency report (checklist) completed; (Prepare and file the emergencies report for every single emergency situation.)

Emergency report filed and one (1) copy submitted to DEP Regional Office - DWP.

Other: _____

EMERGENCY RESPONSE LEVELS (DEP, August 2002)

Level I Routine Problems

These incidents are minor disruptions to the water system that affect 10% or less of the system and are anticipated to be repaired/resolved within 24 hours or less. **Examples:** *Water main breaks and mechanical problems at pumping stations.*

Level II Alert/Minor Emergencies

These incidents are more significant disruptions to the water system that affect 50% or less of the system and are anticipated to be repaired/resolved within 72 hours or less. **Examples:** *Local total coliform bacteria detection, major main breaks, multiple main breaks, major mechanical problems at pumping stations/treatment facility, or failure of chemical feed systems.*

Level III Major Emergencies

These incidents are very significant disruptions to the water system that affect more than 50% of the system and/or are anticipated to require more than 72 hours to be repaired/resolved. Major emergencies may require a Declaration of Water Supply Emergency and/or a Boil Water Order, Do Not Drink Order or Do Not Use Order. **Examples:** *Break in major transmission main, loss or failure of treatment facility, loss of source (dam break, water supply shortage, contamination, etc.), loss of pressure in system, widespread total coliform bacteria outbreak, fecal coliform or E. Coli detection, or acts of vandalism.*

Level IV Natural Disasters

These incidents are generally caused by a widespread meteorological or geological event that disrupts the water system affecting more than 50% of the system and/or requiring more than one week for recovery of services. Such events may cause structural damage to a treatment facility or contaminate a source with untreated sewage, toxic chemical, or radioactive material. A Declaration of Water Supply Emergency and/or a Boil Water Order, Do Not Drink Order or Do Not Use Order are likely to be required. **Examples:** *Hurricanes, tornadoes, earthquakes, or floods.*

Level V Nuclear Disasters/Terrorist Acts

These incidents involve large and uncontrolled releases of radioactive material or compounds into the environment/water supply source or deliberate acts that impair a water system (i.e. terrorism). In the case of nuclear disaster, surface water supplies within a 50-mile radius of a nuclear power plant experiencing such a release may be immediately contaminated. Groundwater supplies may remain safe for a period of time. A Declaration of Water Supply Emergency and/or a Do Not Drink Order or Do Not Use Order are likely to be required. **Examples:** *Nuclear power plant release to the environment or deliberate release of highly toxic materials to a water supply.*



Massachusetts Department of Public Health
FACT SHEET

Emergency Management and Public Health

How Are Emergencies Handled in the Commonwealth of Massachusetts?

The Massachusetts Emergency Management Agency (MEMA) coordinates federal, state, local, and private resources throughout the Commonwealth during times of disaster and other types of emergencies. With headquarters in Framingham and four regional offices, MEMA helps develop response plans for all types of hazards, trains emergency personnel, and assists communities in responding to and recovering from emergencies. MEMA maintains and operates the State Emergency Operations Center (SEOC) which monitors for emergencies statewide 24 hours a day, 7 days a week.

The SEOC serves as the command and control center for the Commonwealth during an emergency. Fully activated, the SEOC is staffed according to 16 Emergency Support Functions (ESF). The many federal, state, local, volunteer, public and private organizations that comprise the ESFs are part of the Massachusetts Emergency Management Team (MEMT). The MEMT is coordinated through and trained by MEMA. The Department of Public Health heads ESF 8 (see below).

Activation of the SEOC 1) enhances the Commonwealth's communication capacity between and among its various agencies, 2) facilitates communication with other states, the federal government, and local public and private entities across the Commonwealth, and 3) enables the capacity to deploy assets, support operations to ESFs, and ensure timely and appropriate response to the emergency. The 16 ESFs represented in a full activation include:

ESF 1 Transportation	ESF 10 Hazardous Materials & Environmental
ESF 2 Communications	ESF 11 Food and Water
ESF 3 Public Works and Engineering	ESF 12 Energy
ESF 4 Firefighting	ESF 13 Military Support
ESF 5 Information and Planning	ESF 14 Public Information
ESF 6 Mass Care	ESF 15 Volunteers
ESF 7 Resource Support	ESF 16 Law Enforcement
ESF 8 Health and Medical	
ESF 9 Search and Rescue	

The Massachusetts Department of Public Health (DPH) is responsible for maintaining the ESF 8 Health and Medical Services Plan and staffing the ESF 8 desk at the EOC. Typically, two or three senior DPH staff are assigned to the SEOC. ESF 8 staff are responsible for working with partner agencies (such as the Department of Mental Health, the Medical Examiner's Office, and Disaster Medical Assistance Teams) to coordinate the provision of field services including:

- Assessment of health and medical needs
- Provision of emergency medical services

- Environmental and communicable disease control/epidemiology
- Toxicological assessment
- Provision of health care/medical personnel, equipment, and supplies
- Patient evacuation
- Hospital care coordination
- Food and drug safety
- Radiological, chemical, and biological hazards
- Mental health and crisis counseling
- Public health information
- Victim identification and mortuary services

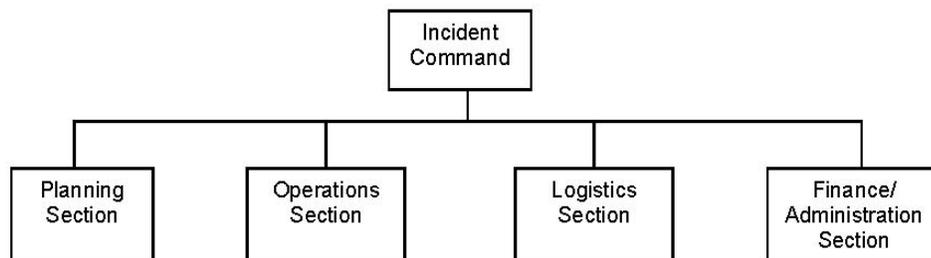
The regional office of the U.S. Public Health Service, located in Boston, may also be represented at the SEOC should federal resources be required. The ESF 8 desk fields health and medical-related calls during the SEOC activation, and also maintains emergency call lists.

How are Incidents Managed On-Scene?

Most emergency incidents – whether a chemical spill, explosion, house fire, or utility outage, or disasters such as tornadoes, earthquakes, or terrorist events – require a response from a variety of agencies. Regardless of the size of the incident or the number of agencies involved in the response, all incidents require a coordinated effort to ensure an effective response and the efficient use of resources.

The management structure used most often in on-scene emergency response is the **Incident Command System (ICS)***. The ICS is an organized approach to managing emergency situations that was first developed in the 1970s in response to a series of major wildfires in Southern California. Over the years, its principles have been applied to many situations including HazMat incidents, planned events (such as parades, concerts, official visits, etc.), mass casualty incidents, air, rail, water, and ground transportation incidents, and search and rescue missions. Today, federal law requires the use of ICS for response to HazMat incidents; most fire service, law enforcement and EMS officials are trained in the use of ICS.

The five major components of the ICS are: incident command, planning, operations, logistics, and finance/administration. All incidents have a designated incident commander who is in charge at the scene.



The **Incident Commander** is usually the highest-ranking first responder (e.g., police, fire, etc.). His/her major responsibilities are to establish the command, protect life and property, control personnel and equipment resources, maintain accountability for responder and public safety, and act as a liaison to outside agencies. As incidents develop, the incident commander may delegate some of these functions to other command staff positions such as an information officer, safety officer, or liaison officer.

The **Planning Section** is responsible for documenting the status of resources and developing the Incident Action Plan (which defines response activities and resource utilization). The **Operations Section** is responsible for carrying out the response activities defined in the Incident Action Plan. The **Logistics Section** provides the facilities, services, materials, and personnel needed to operate equipment. The **Finance/Administration Section** is responsible for tracking incident costs and reimbursement accounting.

No single agency or department can handle an emergency situation alone. Response agencies commonly utilized in an emergency are fire services, law enforcement, emergency management, public health (including EMS), public works, and relief organizations such as the American Red Cross. All personnel and resources involved in a response effort are assigned to one of the five functions (Planning, Operations, Logistics, or Finance/Administration).

When the magnitude of a crisis exceeds the capabilities and resources of the local incident commander or when the efforts of multiple jurisdictions are required in order to resolve a crisis situation, the ICS command function evolves into a **Unified Command (UC)**. Under UC, a multi-agency command post is established, incorporating officials from agencies with jurisdictional responsibility at the incident scene. Multiple agency resources and personnel are then integrated into the ICS as the single overall response management structure at the incident scene.

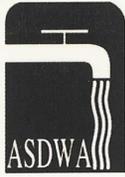
How Does Public Health Fit into the Incident Command System?

Various sectors of the public health community, in particular EMS, historically have played a role in the ICS. Local health departments and hospitals are encouraged to have a working knowledge of ICS and UC for the following reasons.

- Increasingly, first responders are asking hospitals and health departments to provide on-scene technical assistance; in a chemical or bioterrorism threat situation, health and medical professionals will be expected to play a major role in first response.
- In emergency situations, public health has its own ESF 8 authority in an incident command structure; public health personnel and resources may be assigned to planning, logistics, operations, or administrative functions, and become part of a Unified Command.
- Certain public health functions are key components of an ICS; EMS may play a role in the Operations Section, while hospitals that are helping to provide patient beds may be a component of the Logistics Section.
- The standards of the Joint Commission on the Accreditation of Healthcare Organizations (EC.1.4 and EC.2.4) require accredited healthcare organizations to identify a community command structure and define an all-hazard command structure within their organization that links to the community structure.
- Whether on-scene or not, health officials should be aware of the ICS management structure because it is the vehicle by which public health and health care issues are tracked and managed during an emergency incident.

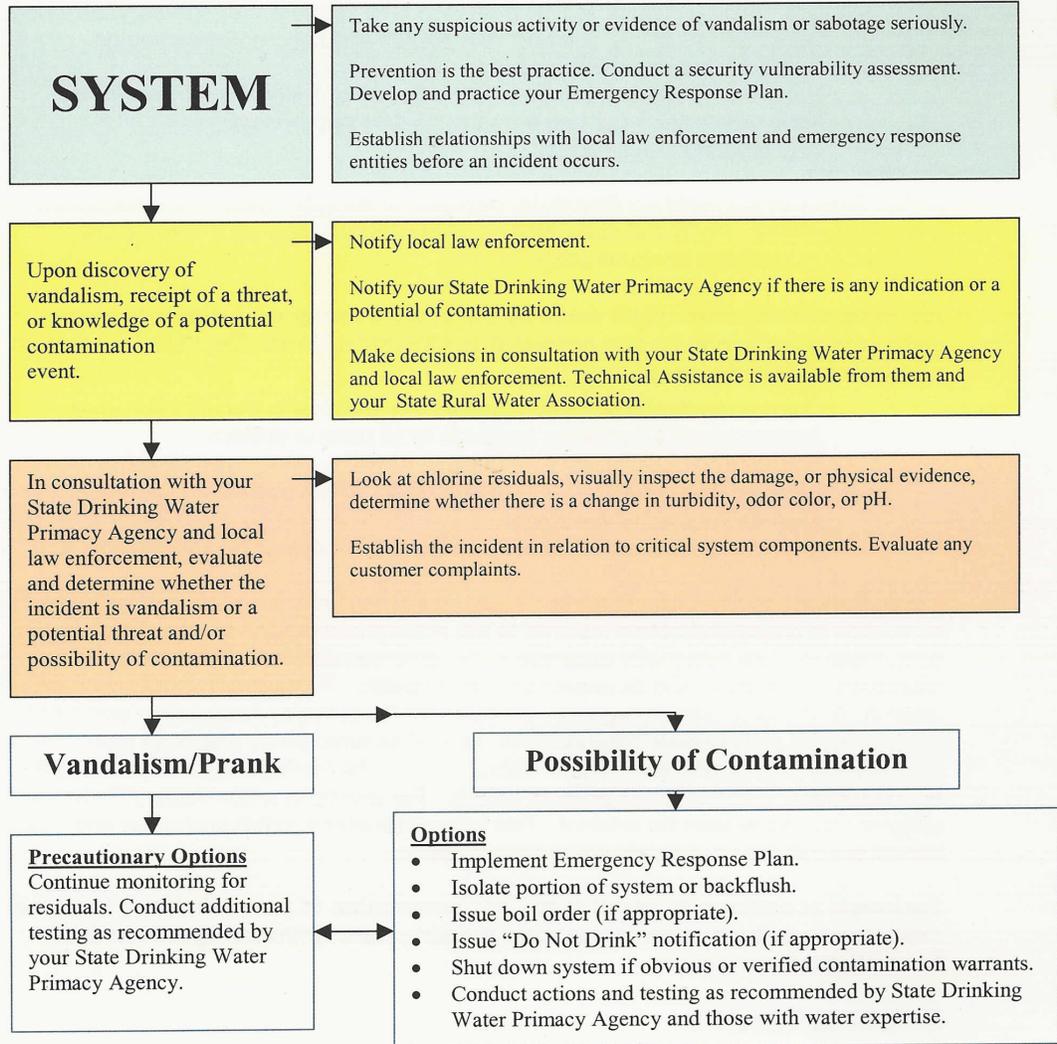
General emergency preparedness information can be obtained by visiting the MEMA website at <http://www.state.ma.us/mema/>. Public health emergency preparedness information is available at <http://www.state.ma.us/dph/>.

* Adapted from FEMA's Basic Incident Command System Independent Study Course available at www.fema.gov/emi/is195lst.htm.



A Utility Guide For Security Decision Making

These guidelines are designed to assist utilities in determining the level of security concern if a break-in or threat occurs at the water system and to assist the utility in appropriate decision making and response actions. These various steps and actions can be adjusted to meet the needs of specific situations and to comply with individual state requirements. **Specific actions should be undertaken in consultation with your State Drinking Water Primacy Agency.** Technical assistance is available from your state drinking water primacy agency and state rural water association for prevention initiatives such as vulnerability assessments, emergency response planning, and security enhancements.



- Do not disturb evidence and document what you see. Keep notes and take photos as you go.
- Collect samples for future analysis and store them appropriately.
- Alert other officials as appropriate and keep the public informed (designate one spokesperson).
- Use the expertise in public drinking water supplies and public health in the decision making process.
- Preventative measures are the best practice to prevent such an incident.
- Prior communication with the local law enforcement authorities and local emergency response entities prevents confusion and defines who has responsibility for what, when an incident occurs.

A Joint Collaboration between the National Rural Water Association and the Association of State Drinking Water Administrators

Prevention First Simple security precautions and procedures should be a first priority for all size systems. Conducting a security vulnerability self-assessment and developing and practicing your Emergency Response Plan in cooperation with your local law enforcement and local emergency response entities prior to an incident is essential for a proper response to any emergency.

Discovery or receipt of threat

- Take any suspicious activity or evidence of vandalism or sabotage seriously.
- Document what you see and take photos and keep notes as you go.
- Contact local law enforcement.
- Notify the regulatory authority (State Drinking Water Primacy Agency).
- Notify other agencies and organizations as appropriate.
- Map customer complaints.

In The Event of An Incident (break-in, damage or threat) - Local law enforcement should be notified. Notify the state drinking water primacy agency if there is any question or potential of contamination.

An initial evaluation must be made by the system owner or operator to make appropriate decisions on any actions that should be taken. The initial evaluation should include a review of:

- Physical evidence such as containers or material in the intrusion area.
- A quick check for chlorine residuals in all parts of system.
- A visual check of finished water as to turbidity, odor, color, or pH.
- Intrusion or incident location in relation to critical system components such as finished water supply.
- Other items and areas relevant to the system operation and environment.

Consultations in Decision Making - The system may want to obtain assistance in the evaluation process and obtain input as to the appropriate actions to take. This input is best obtained from those with expertise in law enforcement, and drinking water treatment, distribution, and its impact on public health. The system should work with the state drinking water primacy agency, the National Rural Water Association and other drinking water professional organizations, as well as emergency response agencies, in the decision making process. These decisions must be made jointly to ensure public health protection and to avoid adverse affects. For example, a non-water person may suggest that the system be drained. This has ramifications in fire protection and could impact the integrity and safety of the water supply.

Technical assistance to assist in the implementation of preventative or remedial measures is available from your state drinking water primacy agency or State Rural Water Association.

Actions to Consider

The system must make decisions as to what level of actions must be taken to perform due diligence in protecting the public health and provide a safe quality water supply. Actions can range from a determination that the incident is a prank with no action needed to implementing additional monitoring as a precautionary measure. If contamination is indicated, the system may declare an emergency and implement their emergency response plan. **These decisions impact public health and safety and should be made in cooperation with law enforcement and your State Drinking Water Primacy Agency.**