EXHIBIT 6

8.0 RECOMMENDATIONS

Water quality goals and recommendations for the Pennichuck water supply have been developed based on the data collected, identified, generated and analyzed during this study including historical water quality data, land use data, hydrologic and nutrient modeling, water supply regulations, pollution sources and existing protection efforts.

A phosphorus and hydrologic analysis of the watershed along with limited sampling data show excess levels of phosphorus in most of the ponds. These excess levels were identified considering the detention the chain ponds provide to one another in series. This is the result of the overwhelming detriment of development which has increased nutrient loadings into the ponds and has likely added to the filling of the ponds, reducing both their capacity and detention benefit. Based on the identified phosphorus levels in the ponds, actions need to be taken to reduce the existing loadings into the system and to minimize additional loadings from future development.

Since most of the communities that make up the watershed do not receive water from this supply, it is important to build a positive relationship with the communities to receive their support and assistance in the protection of this supply. This may be assisted by the fact that the types of protective actions needed by Pennichuck will also help these communities protect their own quality of life, so there can be many common goals.

The most important parameter to control in a surface water supply is phosphorus due to the impacts it has on a surface drinking water supply, which include the filling of the ponds and taste and odor problems. Based on a model run for the watershed, the theoretical in-pond phosphorus concentration for Harris Pond was estimated at 0.033 mg/l which corresponds with the average sampled data of 0.04 mg/l for the 1995 through 1996 sampling period. This is approximately twice the desired phosphorus level (0.02 mg/l) for an unfiltered surface drinking water supply. Although 0.02 mg/l is desired for an unfiltered surface water supply, it may not be realistically achievable for the Pennichuck water supply system, thus a phosphorus goal of 0.025 mg/l is recommended.

In order to achieve a phosphorus water quality goal of 0.025 mg/l in Harris Pond, the pollutant loadings entering the pond need to be reduced to an acceptable level that the pond can handle. Using the phosphorus model, the quantity of phosphorus that needs to be removed from the Pennichuck watershed was calculated. Based on these calculations, about 2,200 pounds of phosphorus per year need to be removed from the watershed to reach a recommended water quality goal of roughly 0.025 mg/l of phosphorus.

The following recommendations focus on actions required to assess and prevent the further degradation of the Pennichuck chain pond system, including

both preventative and remedial best management practices (BMPs). Each of the recommendations is geared towards meeting a phosphorus concentration of 0.025 mg/l in Harris Pond. Recommended actions and the pollution threats addressed by each group are described below and summarized in Table 8-1.

8.1 Preventative Practices

A. Require Setback / Buffer Zone

A setback or buffer zone is a strip of land, surrounding a surface water body including tributaries, ponds, lakes and reservoirs. A buffer is typically land left in its natural state to provide protection from non-point source pollution (sediment, nutrient, heavy metals, toxics, pesticides, pathogens, salt and thermal pollution). They also prevent detrimental land uses from developing directly adjacent to streams and other water bodies, which helps to decrease the pollutants these land uses may otherwise contribute. At the same time, buffer strips add the additional benefit of helping with bank stabilization and to protect riverfront habitat and the river ecosystem.

Buffer zones are often between 35 and 300 feet in width, depending on the vegetation, slope, and soil type. The median width is 100'. There is no consensus on the widths necessary to protect surface waters since studies are usually site-specific and designed for a particular problem (sedimentation, nutrient removal). The *MA Riverways Community Guide* provides some background on previous studies and common widths used for specific pollutant removal. These widths are provided below, additional information on buffer strips and studies is included in Appendix H.

- ❑ For sediment retention, 50-160' is adequate.
- ❑ For nutrient retention, between 150' – 300' worked best.
- ❑ For pesticide retention, between 50-80 feet for ground application, but up to 300' for aerial application.
- ❑ Pathogens have been found within 2'-2700' from a source, not enough research has been done on the effects of buffer strips on pathogens.
- ❑ At least 50-100' is required for bank stabilization.
- ❑ Many communities suggest that the buffer fully incorporate the lands of the 100-yr floodplain (Schueler, 1995).
- ❑ Some communities include critical areas and delineated wetlands in their buffer distances.

The following actions are recommended:

1. Require a 300-foot setback/buffer from all tributaries to the chain pond system including the ponds themselves. This buffer may not be applicable to all locations of the watershed, but should be applied wherever possible. If possible, this setback should be incorporated into the watershed regulations.
2. Work with the local planning departments and conservation commissions to incorporate a 300 foot buffer in local subdivision and planning regulations to the extent possible.

B. Public Education

A public education program should be developed to focus on the general public and more importantly the local boards and departments, since they will be largely responsible for implementing proposed water quality management techniques.

A public education program can serve to educate the communities on the importance of watershed protection and may help to reduce bacteria and nutrient loadings to the watershed by improving lawn care practices and informing the public of the appropriate method for disposing of pet wastes. Additionally, the community can become more involved through school programs and implementation projects. The following actions are recommended:

1. Consider the formation of a Pennichuck Water Works watershed protection committee to include Pennichuck staff members and members of the local governments contained within the watershed, such as the Nashua and other Conservation Commissions.
2. Prepare and distribute education materials regarding watershed practices to the local governments and residents. Education materials may include "How To" pamphlets on limiting fertilizer and pesticide use and the available alternatives for residential and commercial lawn care. These educational materials are readily available from agencies like EPA and other water suppliers, and could form the backbone of a series of news articles or information given out to landscapers and hardware stores regarding the use and availability of alternative products. Pamphlets informing the public of the impacts pet waste and livestock can have on a water supply and proper disposal techniques may also be created and distributed.
3. Contact local schools within the key subwatersheds to determine the level of interest in participation in a demonstration project. A demonstration BMP can be developed by Pennichuck Water Works which will show students the principles of water quality maintenance and at the same time reduce pollutant loadings from a source or tributary to the water supply system. Also consider other school education activities.
4. Encourage the maintenance of riparian buffer zones along tributaries of the chain ponds. Although businesses and residents may sometimes believe that the "well-manicured" golf course look is environmentally sound, mowing up to the streambank reduces the trapping efficiency that a natural buffer

can provide. Thus it is important to provide education on the importance of natural vegetation to minimize the impacts of pollutants carried in stormwater.

5. Increase public awareness of the dangers of illegal dumping through a storm drain stenciling program and accompanying press releases. Some residents may be unaware that a particular drain discharges directly to a tributary of the water supply or to the water supply itself. Increasing public awareness may help avoid future dumping and the use of storm drains for waste disposal.

C. Work to Modify Subdivision Bylaws

A review of the existing land uses and future land uses based on zoning indicates that there is still much land that may be developed within the watershed. As development takes place, pollutant loadings reaching the river from urban runoff can be expected to increase. Improving the existing bylaws will reduce the impacts of future development in the watershed. Consistent setback/buffer requirements will assist in minimizing the pollutant concentration entering into tributaries and the chain pond system. Additionally, minimizing the impervious area in future developments will also reduce the amount of surface runoff entering the water supply and consequently will reduce the potential loadings to the system. Strict development water quality standards can also reduce impacts by requiring contractors to take it upon themselves to reduce the impacts a development can have on the water supply. The overall effects of improved subdivision regulations can be to minimize the potential pollutant loading from future development. The following actions are recommended:

1. Seek a 300-foot setback/buffer from all tributaries to the chain pond system (see Setback/Buffer Zone recommendations above). This buffer zone will help reduce the impacts of urban runoff from a site by allowing the natural vegetation to take up nutrients and by filtering other pollutants in runoff from a specific site. Conservation easements may be a cost-effective alternative to purchase in some cases.
2. Ask Planning Boards to set water quality standards for proposed construction to give developers a guideline for water quality expectations. For example, the bylaws could require that the storm water leaving a site after development meet pre-development water quality levels or meet other performance standards. Several BMPs exist to reduce the impacts of storm water from development. Stormwater BMP guidance may be made available to local contractors through the local planning committees.
3. Encourage the reduction of impervious cover in proposed subdivision developments through narrower streets, clustering and decreased land clearing. Cluster development can reduce site imperviousness by 10 to 50%, depending on the original lot size and road network (Schueler, Fall 1994).
4. Work with the local Planning Boards to improve local subdivision regulations and incorporate the above recommendations. Technical assistance should be provided to each of the communities during the first stages of implementing the improved local bylaws.

D. Encourage Preventative Agricultural BMPs

Although there is not much agricultural land within the watershed (only 624 acres, 3.5% of the watershed), the potential does exist for the development of agricultural lands in the future. As seen by the buildout scenarios assuming an agricultural buildout in Hollis, the development of these lands can have a detrimental effect on the pond system. Agriculture also has the potential to introduce pathogens to the system.

Most agricultural BMPs are preventative in nature in that they prevent pollution from occurring rather than capturing and treating the pollutant from an existing source. Table 8-2 outlines preventative agricultural BMPs that may be applied in the Pennichuck watershed. The implementation of agricultural BMPs can greatly reduce the amount of erosion from these areas, which can decrease the sediment traveling to the streams. Additionally, management programs can be used to reduce pesticide and nutrient loadings from agricultural areas. Recommended actions include:

1. Require setback requirements for all standing and feeding places for horses and other livestock. Often a 300-foot setback is necessary to remove a majority of the sediment and nutrients from the streams. See appendix H for an evaluation of buffer widths. In some cases Pennichuck may need to help farmers develop alternate sources of water for livestock.
2. Work with the Natural Resources Conservation Service (NRCS) to encourage existing and future farmers to implement preventive BMPs such as conservation tillage and contouring.
3. Encourage farmers in the watershed to incorporate integrated pest management and nutrient management practices. This will decrease the amount of toxic pesticides and fertilizer use close to the tributaries of the chain ponds.

8.2 Remedial Measures

A. Implement Baseline Monitoring Program

A review of historical data reveals a minimum amount of phosphorus data. A baseline monitoring program should be conducted to obtain more information on the existing health of the ponds. The program will provide long-term trending information to further identify problem areas in the watershed where investigatory sampling may be conducted to pinpoint sources of pollution. Sampling in the watershed should also include depth samples taken from each of the ponds. The monitoring program is outlined in more detail in the water quality section (Section 3.0). Recommended actions include:

1. Implement the baseline monitoring program described in Section 3.0 to include sediment depth mapping and depth sampling at the ponds.

2. Develop an investigative sampling program to identify illicit connections when bacteria levels are excessive and coordinate with the appropriate Board of Health (BOH) agent when specific tributary segments are pinpointed.
3. Monitor the effectiveness of installed BMPs with pre- and post-monitoring stations to determine the removal efficiency of critical parameters including nutrients, bacteria and sediments so modifications can be made as necessary.
4. Create graphs of all monitoring data to evaluate trends in the data.

B. Implement Stormwater Sampling Program

Stormwater runoff has been identified as a major contributor of pollution to surface water bodies in urbanized areas. There is little data in the Pennichuck watershed on the impacts stormwater runoff is having on the pond system. A proposed stormwater monitoring program was developed in the water quality section of the report (Section 3.0) to identify the pollutant load associated with stormwater runoff from various types of land uses in the watershed. It is recommended that Pennichuck Water Works implement the stormwater sampling program identified in Section 3.0.

C. Conduct Sediment Mapping in the Chain Ponds

Results of the nutrient analysis show that the ponds can provide a significant level of detention to reduce the overall impacts of the final ponds in the chain (Harris and Supply Pond). However, if these ponds fill in, the detention will be reduced and the sediments may actually become a source of phosphorus and other nutrients to the drinking water sources, therefore it is critical to maintain the capacity of these ponds. Sediment mapping in each of the chain ponds should be conducted to determine the existing capacity of the ponds and to identify to what extent the ponds have been filled in. Results of the sediment sampling will give Pennichuck Water Works direction as to whether or not the ponds need to be dredged. The following actions are recommended:

1. Conduct sediment depth sampling in each of the ponds.
2. Map sediment depths for each of the ponds to determine the level that each pond has been filled in and to determine the existing capacity of each.

D. Stormwater Runoff

Stormwater runoff is the carrier of pollutants from all of the non-point pollution sources identified in Section 5.0. One way to control the effects of stormwater runoff to the Pennichuck water supply is through the use of structural BMPs used to capture and treat stormwater before discharging it into a tributary or water body. These types of remedial structures will reduce sediment and nutrient loadings into the chain pond system. The extent to which BMPs may remove bacteria has not been well researched and is unknown at this point. The following actions are recommended:

1. Review the subwatersheds that contribute the greatest pollutant loads to the water supply including PB-2, PB-1, PB-3 and BFB-1 (in that order) to identify areas where BMPs may be applied. The modeling predicted these subwatersheds to contribute the greatest amount of pollution to the water supply; thus remedial efforts should be focused in these areas. Although SB-1 was also identified as one of the highest contributors of phosphorus, the loadings from this pond do not have a significant impact on Harris and Supply Pond where the intake is. Thus, remedial measures need not be a priority in this subwatershed, but should be considered to decrease the impacts on Stump Pond. Specific areas of concern were identified in Section 5.0 including runoff from industrial, residential and commercial areas throughout the watershed as well as transient construction sites.
2. Apply BMPs to existing targeted areas within the watershed. These may include anything from leaching catch basins to detention basins and wet ponds. A summary of available stormwater BMPs is provided in Table 8-3.
3. Incorporate BMPs into local subdivision regulations to require contractors to implement BMPs for any new development project.

E. Sanitary Survey

A sanitary survey of the entire watershed should be conducted to determine the locations of illicit discharges and possible failing septic systems. This type of survey will assist in further defining the existing pollution sources in the watershed and will identify unknown sources of pollution. Locations such as the Chicken Hutch Mall, which is suspected to have a faulty septic system, may be inspected and corrective actions enforced through the local Health Departments in each of the communities. By identifying such pollutant contributors as faulty septic systems and illegal discharges, bacteria and nutrient levels entering the ponds may be reduced. Additionally, other illegal discharges from industrial operations may also be identified and corrected to reduce the potential discharge of hazardous materials into the water supply. The following actions are recommended:

1. Conduct further bacterial investigative sampling as needed to further identify areas of concern.
2. Using bacterial data, conduct an inspection of the watershed to identify illicit discharges and faulty septic systems that may be contributing pollutants to the chain pond system.
3. Coordinate with the local Boards of Health to further assess and correct identified problem areas within the watershed.

F. Airport Coordination

As indicated in Section 5.0, an airport in Nashua lies within the watershed delineation boundary located adjacent to a tributary that drains directly into Harris Pond. The airport is considered to be a large potential source of pollution due to the large impervious area and the activities that typically take place at an airport.

Sediments, oil and grease from airport parking lots can be reduced up to 80% using some of these stormwater control techniques.

Work with the airport authorities to try and provide runoff control from the runway and parking lots. Products such as *Stormceptor* are made to replace manholes while collecting sediments, oil and grease from industrial and commercial parking lots. These can be easily retrofitted into existing systems.

G. Modify Watershed Stormwater Discharges

Protect the Pennichuck water supply from existing and future development through a goal of zero direct discharge (no piped discharges) to the ponds or their tributaries. This goal will take several years to accomplish and will require Pennichuck to encourage the N.H. Highway Department and the local Public Works Departments to implement no-discharge practices in roadway construction and modification projects.

By implementing a no direct discharge program, pollution threats from major roadway crossings of tributaries and ponds can be minimized. This will also allow more time for a spill to be contained and cleaned in the event of an accident at a major crossing. Thus, not only will it reduce the everyday loadings from contaminants such as oil and grease that settle on the impervious surface of the roadway, but it will also prevent other potential contaminants, such as hazardous materials, from entering a tributary or pond during a roadway accident. The following actions are recommended:

1. Develop a municipal guidance manual suitable for Public Works Departments geared to assure that reconstruction projects apply no discharge design principles.
2. Encourage the N.H. Highway Department to implement no discharge goals for state roads that cross the ponds or their tributaries, such as Rte. 3. Pennichuck Water Works should request to have input on BMP design standards that are to be incorporated into roadway reconstruction projects.
3. Work on specific sites to identify potential remediation projects.

H. Hazardous Waste Sites Coordination

H.1 State Sites

State sites are those identified as having known or potential hazardous releases. These sites are regulated by and required to report to the New Hampshire Department of Environmental Services (NHDES). NHDES regulations require sites to be cleaned up to acceptable levels or otherwise prove that no significant risk exists on the site. The following actions are recommended:

1. Coordinate with NHDES for prompt notification of identified releases that may impact the ponds.

2. Work with NHDES to ensure that these sites/releases are quickly cleaned to a level that represents no significant risk.

H.2 RCRA Sites and Household Hazardous Waste

There are several RCRA sites located within the watershed, however, these sites should not pose a risk to the ponds if they are operated properly. By conducting periodic inspections of RCRA facilities, those in non-compliance with the regulations may be identified and corrected before causing a potential problem to the water supply. The periodic inspection of these facilities may encourage facilities to become more aware of the existing regulations and operations to remain in compliance so they may avoid fines related to non-compliance activities.

Residents are also capable of generating household hazardous wastes, which may be disposed of improperly if not given the proper means for disposal. Providing annual household hazardous waste collection days will provide residents with a means of disposing of their own hazardous wastes so they will not have to find other avenues of disposal, which could include illegal disposal activities. The following actions are recommended:

1. Coordinate with NHDES for periodic inspections of RCRA facilities located within the watershed. Extra attention may be given to those facilities located close to a pond or tributary to the water supply system.
2. Encourage the communities to provide annual household hazardous waste collection days.