# Appendix A

# Conservation Plans

## Souhegan River Water Management Plan

## August 2013

## CONSERVATION PLAN

### Amherst Country Club (#20190)
### Ponemah Green Family Golf Center (#20624)

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

The Amherst Country Club includes an 18-hole course, while Ponemah Green Family Golf Center includes a 9-hole course, a driving range, chipping and putting greens, and a miniature golf course. Because both golf courses are operated by Amherst Country Club, and the irrigation system for both is managed jointly, this Conservation Plan applies to the combined facilities.

### Water Source and Uses

The Amherst Country Club (20190-S01) and Ponemah Green (20624-S01) share an intake on the Souhegan Designated River and withdraw water directly from the river to irrigate the two golf courses (Figure 1). This intake is located in the Town of Amherst, approximately 12 miles upstream of the confluence of the Souhegan and the Merrimack Rivers. The drainage area of the Souhegan River at the point of withdrawal is 142 sq. miles.

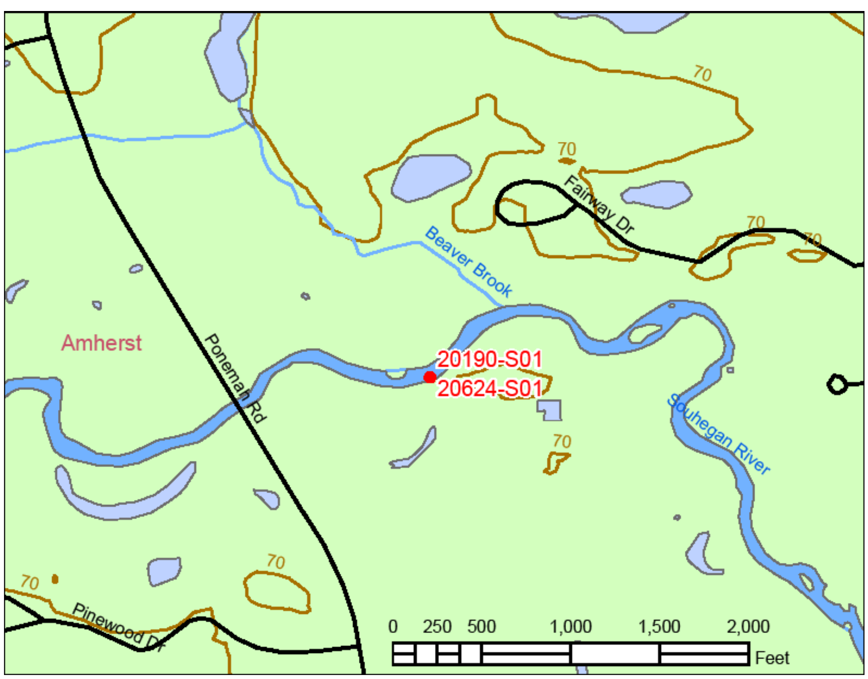


**Figure 1 - Location map of the Amherst Country Club – Ponemah Green Family Golf Center withdrawal point**

Water is withdrawn from the river by two 7.5 horsepower (hp) sump pumps that rest 8-10 inches off of the bottom of the river, and are connected to two separate 6-inch diameter flexible plastic pipes (Figure 2). The two intake pipes transfer water from the river to the pump house. Just before entering the pump house the intake lines join together and discharge into a manifold pipe that splits the water between three water lines (two 4-inch diameter and one 2-inch diameter) that enter the pump house. Each water line is connected to a pump (two 60 hp and one 17 hp), which discharges into the main distribution pipe for the irrigation system. Flow from the main distribution pipe is regulated electronically and water use is measured using an electronic flow sensor and digitally recorded. Water from the main distribution line is then divided into three subsystems: one each for the front and back 9-holes for the Amherst Country Club and one for the Ponemah Green golf course. Although the subsystems can be turned off individually, this is only done in the case of an emergency (leak); otherwise, the system is operated as a single 27-hole golf course. The timing and length of irrigation for sections of each golf course is further regulated by using 18 programmable satellite controllers.

**Figure 2 - Photograph of the Amherst Country Club – Ponemah Green Family Golf Center Souhegan River withdrawal intake.**

Water is withdrawn on an “as needed” basis to irrigate 105 acres of fairways, greens and tees at the golf courses. The purpose of irrigating the courses is to ensure that the various grasses used at the courses remain healthy and adequately watered and to meet user expectations in terms of course appearance, condition and “playability.”

Neither facility has any available storage capacity in their irrigation systems.

**Water Use Patterns**

Water use is metered, recorded monthly and reported to the DES on an annual basis. Water use data for Amherst Country Club and Ponemah Green for the years of 1989 through 2008 are summarized in Figures 3 and 4 as well as Tables 1 and 2. The tables include the conversion of water use from thousands of gallons to cubic feet per second (cfs), as well as to cubic feet per second per square mile of the drainage area to allow for comparison with stream flow values reported for the Souhegan Designated River.

Between 1989 and 2008, annual water use has ranged from a low of 8.52 million gallons (1989) to a high of 34.4 million gallons (1999) and has averaged 24.3 million gallons for the reporting period (Figure 3 and Table 1). During this period annual water use increased by 6.86 million gallons or 81 percent. This represents an average increase of 343,300 gallons per year or 4.1 percent per year.

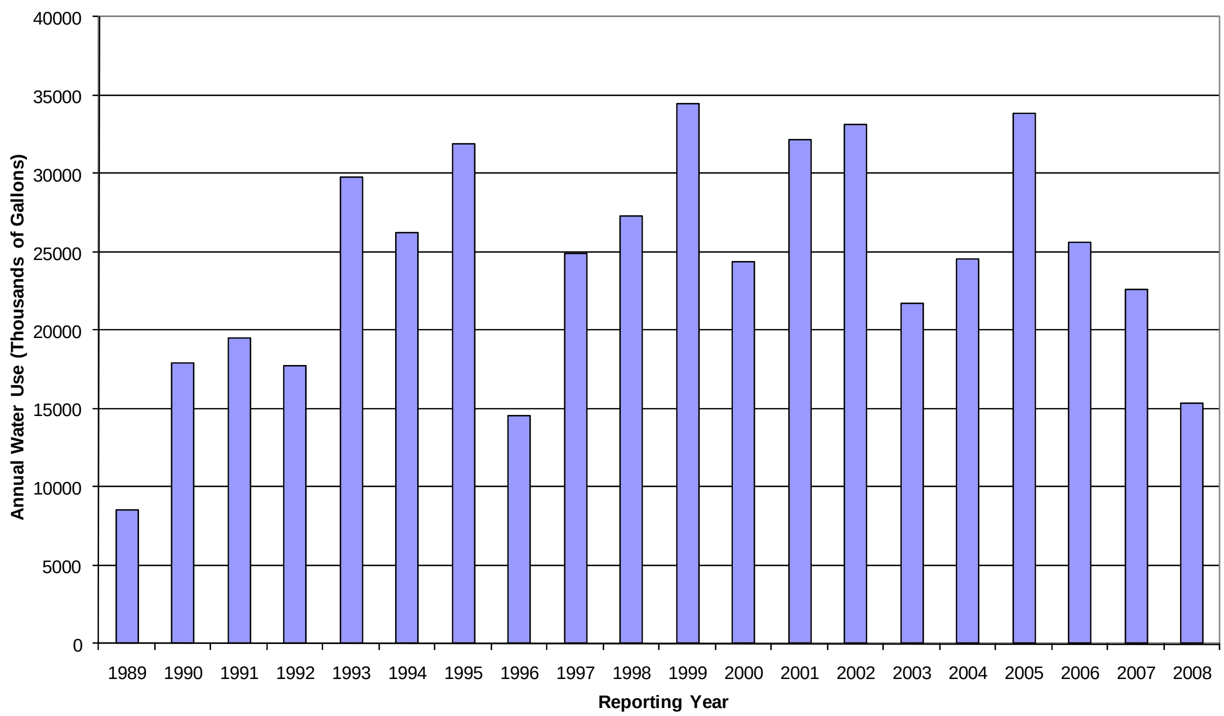


**Figure 3 - Amherst Country Club and Ponemah Green Family Golf Center Annual Water Use, 1989-2008**

**Table 1 - Amherst Country Club and Ponemah Green Family Golf Center Annual Water Use Statistics (1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(1,000 gal)** | 8,520 | 34,400 | 24,300 |
| **(cfs)** | 0.0360 | 0.1460 | 0.1030 |
| **(cfsm at impact point)** | 0.0003 | 0.0010 | 0.0007 |
| **(cfsm at Merrimack Gage)** | 0.0002 | 0.0009 | 0.0006 |

Golf course water withdrawals begin in April, increase to a maximum in July, then decline and end by November (Figure 4). The range in monthly water use reflects the weather conditions that affect the water demand by the golf course turf. Monthly water use for the reporting period has ranged from 0 (multiple occurrences) to 17.1 million gallons (July 2002, a period of drought) and averaged 2.01 million gallons per month over the year (Table 2). When averaged for just the April-October period of water withdrawals, average monthly water use was 3.47 million gallons.

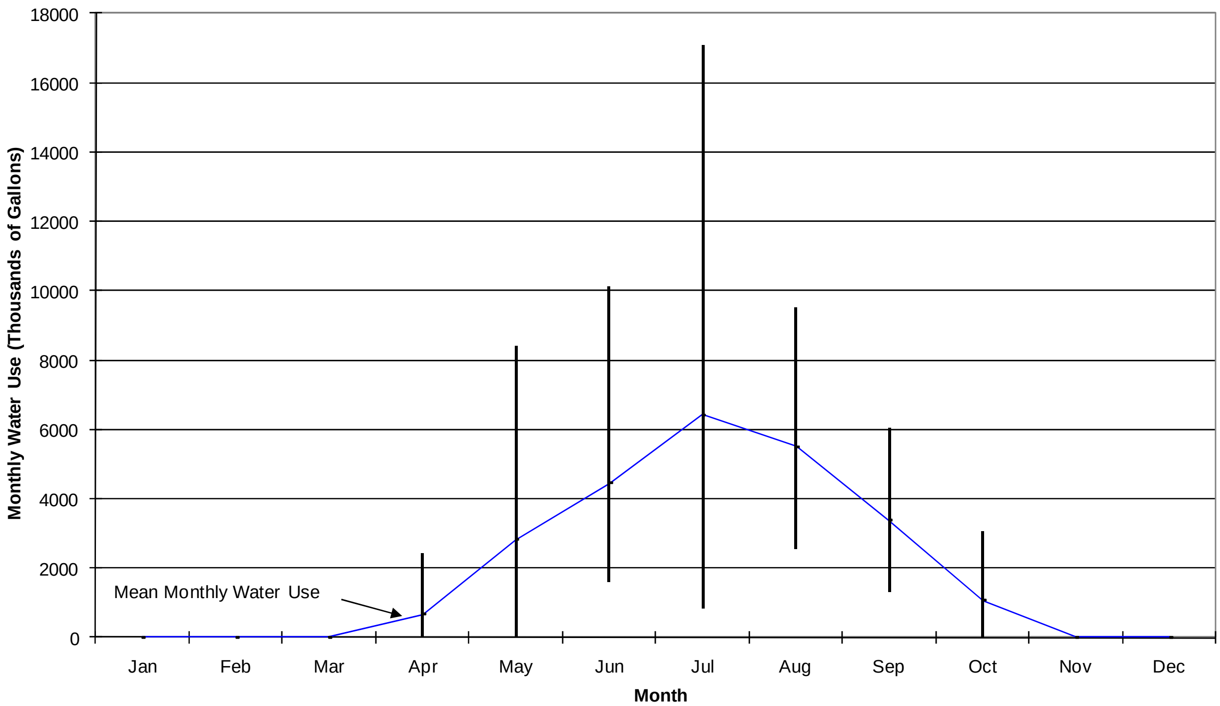


**Figure 4 - Amherst Country Club and Ponemah Green Family Golf Center Monthly Water Use, 1989-2008**

**Table 2 - Amherst Country Club and Ponemah Green Family Golf Center Monthly Water Use Statistics (1989-2008).**

| | Low | High | Average | Apr - Oct avg |
|---|---|---|---|---|
| (1,000 gal) | 0 | 17,100 | 2,010 | 3,470 |
| (cfs) | 0 | 0.8540 | 0.1020 | 0.1760 |
| (cfsm at impact point) | 0 | 0.0060 | 0.0007 | 0.0012 |
| (cfsm at Merrimack Gage) | 0 | 0.0050 | 0.0006 | 0.0010 |

Monthly water use data were converted to flow in cubic feet per second by dividing the monthly totals by days and then multiplying this result by a flow unit conversion factor. Based on these values, the water use of the Amherst Country Club and Ponemah Green Family Golf Center has ranged from a minimum of 0 cfs (several months), to a maximum of 0.854 cfs (July 2002) with an average of 0.176 cfs for the April through October period and 0.102 cfs annually during the last 20 years (Table 2).

**Env-Wq 2101 Requirements for Water Conservation Plans**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Conservation Rules require different activities depending on the type of water use. As a commercial water user, the Amherst Country Club and Ponemah Green need to maintain its source water meter in accordance with the "Manual of Water Supply Practices, Water Meters – Selection, Installation, Testing and Maintenance" (AWWA 1999), follow water conservation best management practices developed for golf courses, and use best available water conservation technologies.

**Existing Water Conservation Measures**

Water use is measured using an electronic flow sensor on the main irrigation distribution line and recorded digitally. The flow measurement sensor is checked annually.

Irrigation is conducted only when needed. The need to irrigate is based on daily checks of the greens, tees and fairway soil moisture and visual turf grass stress. Daily temperature, precipitation and projected local evapotranspiration rates from local weather stations are also used to gage the need for watering.

Water quantities to be applied are controlled by an automatic controller system with timers and automatic shut-off valves. Only greens, fairways and tees are targeted for irrigation. Irrigation is performed overnight (evening to early morning for 10 to 12 hours) to limit water loss to evapotranspiration, although some day-time spot irrigation is conducted. Leaks from the irrigation water distribution are checked constantly from the start up of the system in the spring (April) until it's shut down (blow out) in the fall (November). A water system maintenance program is in place and sprinkler heads and valves are checked regularly. Drought-resistant turf grasses such as the L93 variety of creeping bent grass have been incorporated on some tee areas. On greens, wetting agents are used to hold moisture during hot periods.

**Water Conservation Alternatives and Costs**

Amherst Country Club and Ponemah Green Family Golf Center employ most of the water conservation practices recommended by DES in its Environmental Fact Sheet WD-DWGB-26-6, Water Efficiency: Golf Courses. These practices should be continued and, as appropriate, improved on in the future to further conserve water as part of its normal business operations.

**Conservation Implementation Schedule**

By June 1, 2014, the Amherst Country Club and Ponemah Green Family Golf Center will jointly finalize a Water Conservation Plan in accordance with Env-Wq 2101 in order to meet the

Instream Flow Rule (Env-Wq 1900) requirements for a conservation plan. The Water Conservation Plan will document the Amherst Country Club's and Ponemah Green Family Golf Center's existing water conservation activities.

## Water User Contact Information

**Water User:** Amherst Golf Club and Ponemah Green Family Golf Center
**Address:** 72 Ponemah Rd, Amherst, 03031
**Contact:** Steve Wilson, Golf Course Superintendent
**Phone:** 673-9908 ext. 20
**Email:** SWilson@AmherstCountryClub.com

### Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

American Water Works Association (AWWA) 1999. Water Meters – Selection, Installation, Testing and Maintenance. Manual of Water Supply Practices M6, Fourth Edition.

Department of Environmental Services (DES) 2013. Water Efficiency: Golf Courses. Environmental Fact Sheet WD-DWGB-26-6 (http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-26-6.pdf).

Personal communication with Jamin Warren, Amherst Country Club.

Personal communication with Steve Wilson, Amherst Country Club.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Steve Wilson, Amherst Country Club and Ponemah Green Golf Course.

Water use reports on file with the Department of Environmental Services (DES).

**CONSERVATION PLAN**

**Chamberlain Falls Dam (#20230)**

## Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

Chamberlain Falls Dam is located on the main stem of the Souhegan River in Greenville, New Hampshire (Figure 1). The dam is a privately owned hydropower facility licensed by the Federal Energy Regulatory Commission (FERC Project No. 7922) and registered with the DES Dam Bureau (#101.03). According to DES Dam Bureau records, the concrete, stone and masonry dam is 82 feet long and 20 feet high (Figure 2). The dam creates a small impoundment downstream of the Souhegan River Dam.

## Water Source and Uses

The hydropower operations at Chamberlain Falls Dam are dependent upon the streamflow of the Souhegan River, thus the hydropower operations are registered as a water user (20230) with DES. Water use is reported quarterly. The dam is operated as run-of-river, meaning that the operation of the dam does not alter the flow of the river and all of the water diverted through the hydroelectric turbines is returned to the river via a penstock 20 feet downstream of the dam, into a bedrock-underlain pool.

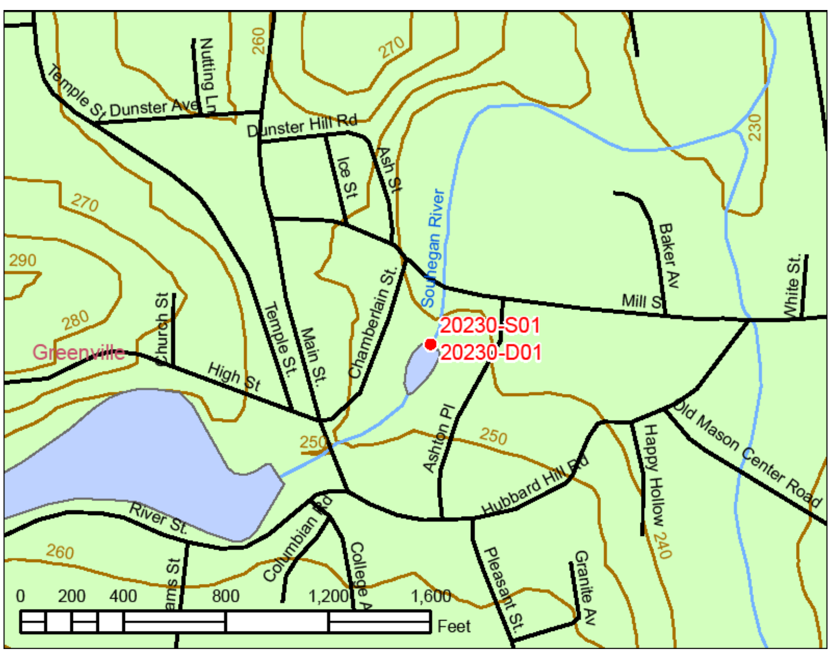


**Figure 1 - Location map of the Chamberlain Falls Dam, Greenville, New Hampshire.**

If sufficient flow is available, the hydroelectric operations at Chamberlain Falls Dam can produce power 24 hours a day, seven days a week, 365 days a year. Under the terms of its license to operate the facility must allow for a minimum outflow of 10 cubic feet per second (cfs) during the summer (June through September) and 15 cfs during the fall, winter and spring (October through May). When the hydropower facility is not operating, all of the water flows over the top of the dam.

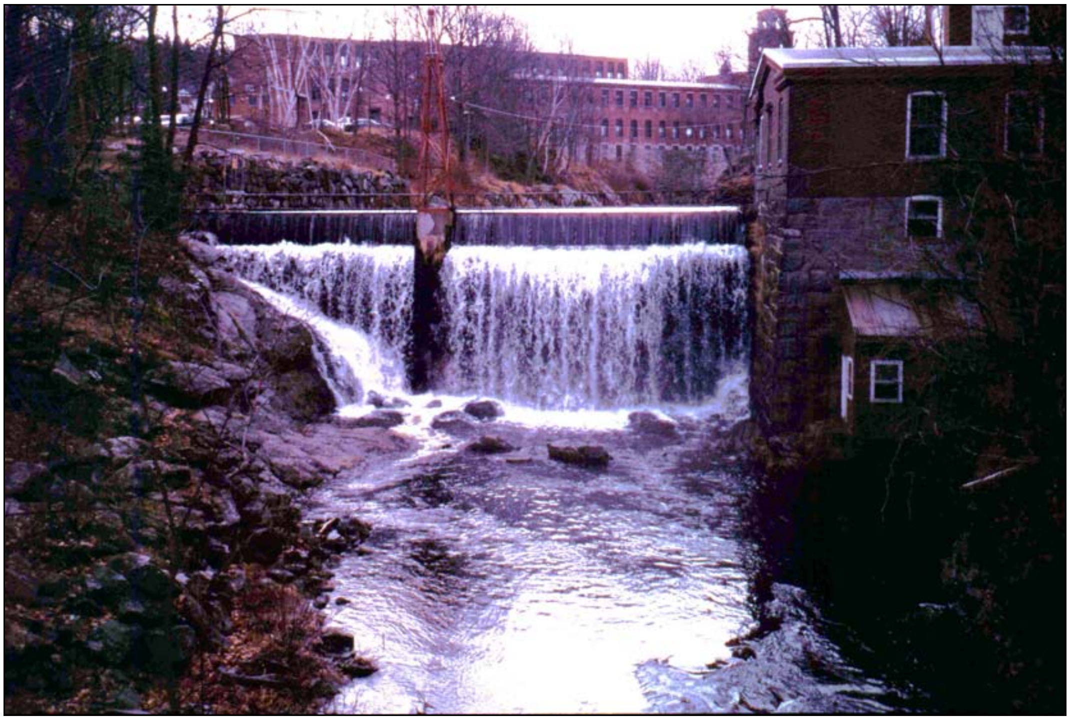

**Figure 2 - Photograph of the Chamberlain Falls Dam, Greenville, New Hampshire looking upstream from the Mill Street Bridge (2004)**

**Water Use Patterns**

Water use data for the Chamberlain Falls Dam, from 1989 to 2008 are shown graphically in Figures 3 and 4 and summarized in Tables 1 and 2.

Water use is dependent on river flow. On an annual basis, Chamberlain Falls Dam water use has ranged from a low of 2,100 million gallons (2001) to a high of 7,470 million gallons in 2003 (Figure 3 and Table 1). Average annual water use was 4,680 million gallons for the fifteen years that a complete record was available (1991-1996, 1998, 2000-2006, 2008). Annual water use has not shown significant upward or downward trends and has mirrored water usage at other Souhegan River dams.

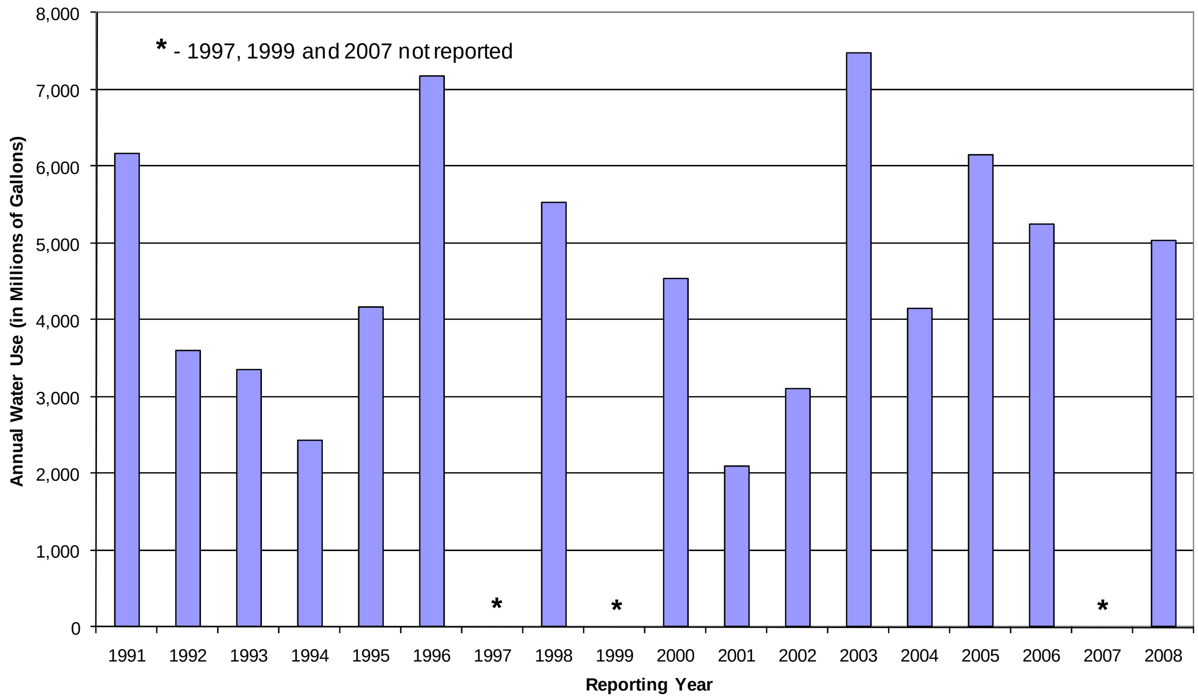


**Figure 3 - Chamberlain Falls Dam Annual Water Use 1991 through 2008.**

**Table 1 - Annual Water Use Statistics (1991-2008).**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 2,100 | 7,470 | 4,680 |
| **(cfs)** | 8.93 | 31.70 | 19.90 |
| **(cfsm at impact point)** | 0.301 | 1.070 | 0.670 |
| **(cfsm at Merrimack Gage)** | 0.052 | 0.190 | 0.116 |

Chamberlain Falls Dam reported a minimum monthly water use of 0 gallons in June 2008. Maximum monthly water use was 1,170 million gallons (April 2008) and the average monthly usage was 393 million gallons (Figure 4 and Table 2). Generally, monthly water use is consistent, varying between 350 and 500 million gallons per month. Greatest monthly usage is typically during April, when river flows are highest, consistent with other run-of-river dams in New Hampshire.

The monthly use data were converted to cubic feet per second by dividing the monthly totals by days and multiplying them by a flow unit conversion factor. Based on these converted values, daily water use by the Chamberlain Falls Dam has ranged from a minimum of 0 cfs (June 2008) to a maximum of 60.2 cfs (April 2008), and average use was 20.0 cfs for the period of 1989 to 2008 (Table 2).

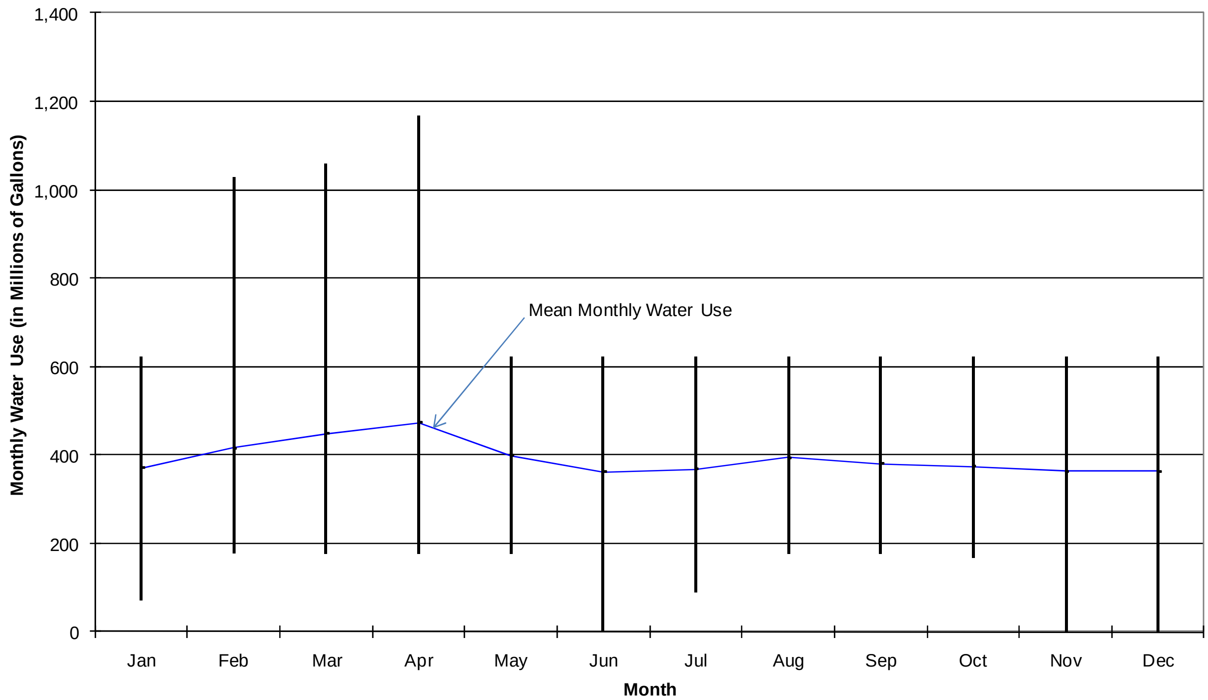


**Figure 4 - Chamberlain Falls Dam Monthly Water Use, 1991-2008**

**Table 2 - Monthly Water Use Statistics (1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 0 | 1,170 | 393 |
| **(cfs)** | 0 | 60.20 | 20.00 |
| **(cfsm at impact point)** | 0 | 2.030 | 0.676 |
| **(cfsm at Merrimack Gage)** | 0 | 0.352 | 0.117 |

## Env-Wq 2101 Requirements for Water Conservation Plan

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. Since Chamberlain Falls Dam is hydroelectric power facility with no consumptive water use, a Water Conservation Plan is not required.

## Existing Water Conservation Measures

Since Chamberlain Falls Dam is managed as a run-of-river operation, no water conservation measures are required at this facility.

## Water Conservation Alternatives and Costs

Since the facility is operated on a run-of-river basis and since there are no consumptive losses associated with its operations, no additional water conservation measures are currently required.

## Conservation Implementation Schedule

Because no additional water conservation measures are currently required, there is no conservation implementation schedule.

## Water User Contact Information

**Water User**: Kathleen R. Dolan
**Address**: PO Box 605, Hillsboro, NH 03244
**Contact**: Kathleen R. Dolan
**Phone**: 478-7828
**Email**: Not available

### Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
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| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

## Sources of Information

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

New Hampshire Dam Bureau, NHDAMS Data Sheet for Chamberlain Falls Dam.

Personal communication with Robert Greenwood, Alden Hydro, LLC.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed with input from Robert Greenwood, Alden Hydro, LLC.

Water use reports on file with the Department of Environmental Services (DES).

# CONSERVATION PLAN

## Greenville Water Works (#20047)

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

The water source Greenville Water Works is the Tobey Reservoir. Water pumped from the reservoir is treated and distributed for domestic use in the Town of Greenville, New Hampshire and is used by Pilgrim Foods (#20681) as industrial process water for the production of canned/bottled food products.

### Water Source and Uses

The Town of Greenville's water supply is the Tobey Reservoir (20047-S01), which is located in Temple, New Hampshire just off of Route 45 (Figure 1). The Tobey Reservoir is a constructed impoundment created by two dams, one to the north on an unnamed tributary of Temple Brook and a second to the south on Richardson Brook, a tributary of the Souhegan River. To the north, Temple Brook flows into Blood Brook in Wilton, which discharges into the Souhegan River near

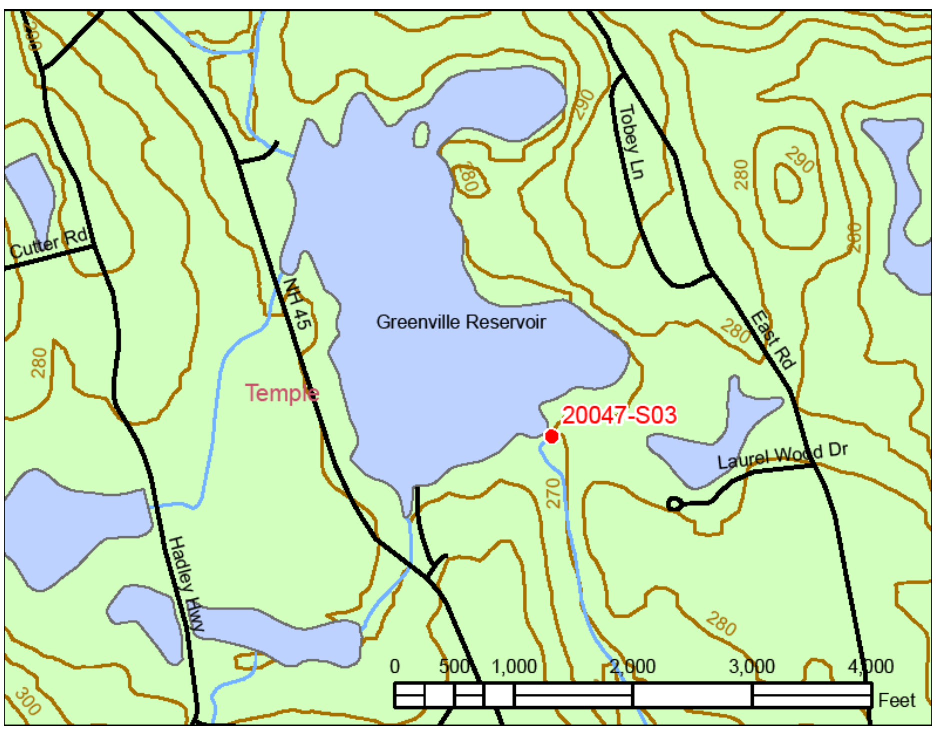


**Figure 1 - Location map of the Greenville Water Supply (Tobey Reservoir), Temple, New Hampshire**

the Town of Wilton's water supply wells, approximately 4 miles downstream of Greenville. Only a small drain pipe is located at the base of the north dam and water is not continuously released from this outlet structure. At the south dam, water is continuously released through an outlet structure to Richardson Brook (Figure 2). Richardson Brook then flows to the south and discharges into the Souhegan River approximately 1.3 miles downstream of Greenville. The major source of water for the reservoir is two small unnamed tributaries located west and southwest of the impoundment.

**Figure 2 - Photograph of Tobey Reservoir Dam (south), the water supply withdrawal point and outlet structure, 2008**

Water withdrawn from the reservoir is pumped to a water treatment plant. The water treatment facility is capable of treating 0.25 million gallons of drinking water per day, and storing 750,000 gallons of treated water. Treated water is distributed to residents and businesses in the town.

## Water Use Patterns

Water is used daily and represents common community and industrial water supply needs moderated by system storage. Daily water demand follows a diurnal pattern, with the greatest water demand during the day and less overnight. Water is pumped from the reservoir and treated prior to storage. Water is distributed from storage to meet demand and to maintain system water pressure for fire suppression. Water use at the treatment facility and at Pilgrim Foods (20681) is metered and monthly totals are recorded and reported quarterly to DES.

Water use data for the Greenville Water Works for the years of 1999 through 2008 are summarized in Figures 3 and 4 as well as in Tables 1 and 2. Water use records were incomplete for 1998, so 1998 was not included in the annual use summaries. The monthly summaries include all available data from 1998 through 2008.

Between 2000 and 2008, annual water use by Greenville Water Works ranged from a high of 67.4 million gallons (2001) to a low of 41.4 million gallons (2004), with and average annual use of 54.0 million gallons (Figure 3 and Table 1). During this period, annual water use declined by 19.86 million gallons or 30 percent. This represents an average decrease of 2.21million gallons per year or 3.4 percent per year over this nine year period. The lack of growth in water use is attributed minimal new development in the town combined with improvements made to the water distribution system to reduce leakage.

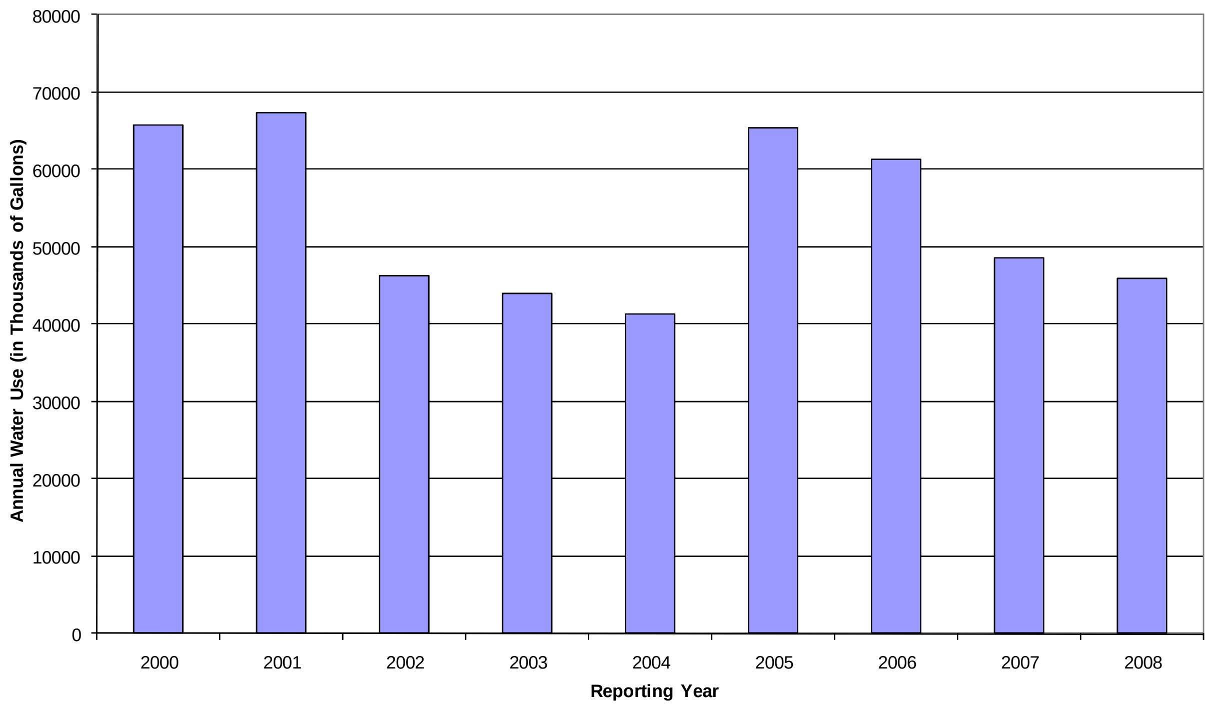


**Figure 3 - Town of Greenville Water Works Annual Water Use 2000-2008**

**Table 1 - Town of Greenville Water Works Annual Water Use Statistics (2000 - 2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 41,400 | 67,400 | 54,000 |
| (cfs) | 0.1760 | 0.2860 | 0.2290 |
| (cfsm at impact point) | 0.0045 | 0.0074 | 0.0059 |
| (cfsm at Merrimack Gage) | 0.0010 | 0.0017 | 0.0013 |

Monthly water use records for the system begin in March 1999. Monthly water use varies in response to weather conditions and changes in seasonal demand. The total and average monthly water usage was highest during summer and lowest during winter (Figure 4). This seasonal pattern reflects increased outdoor water usage (lawn irrigation, garden watering, vehicle washing, etc.) during the summer months. The highest total monthly water use was 7.54 million gallons (April 2005), the lowest total monthly water use was 1.92 million gallons (May and June 2004), while the average monthly water use was 4.56 million gallons (Figure 4 and Table 2). Approximately 12 million gallons of the annual water use is by Pilgrim Foods (20681), an industrial facility in the Town of Greenville. Pilgrim Foods' monthly water use varies in the range of 1.10 to 1.70 million gallons per year.

Monthly water use data for Greenville Water Works were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gage station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire, and normalized to the drainage area (38.8 sq. miles) of the Designated Reach above the impact point of the withdrawal.

Based on these values, the average daily water use by Greenville Water Works has ranged from a minimum of 0.099 cfs (63,986 gallons per day, June 2004) to a maximum of 0.389 cfs (251,419 gallons per day, April 2005), and average use was 0.232 cfs (149,946 gallons per day) for the period of 1999 to 2008 (Table 2).

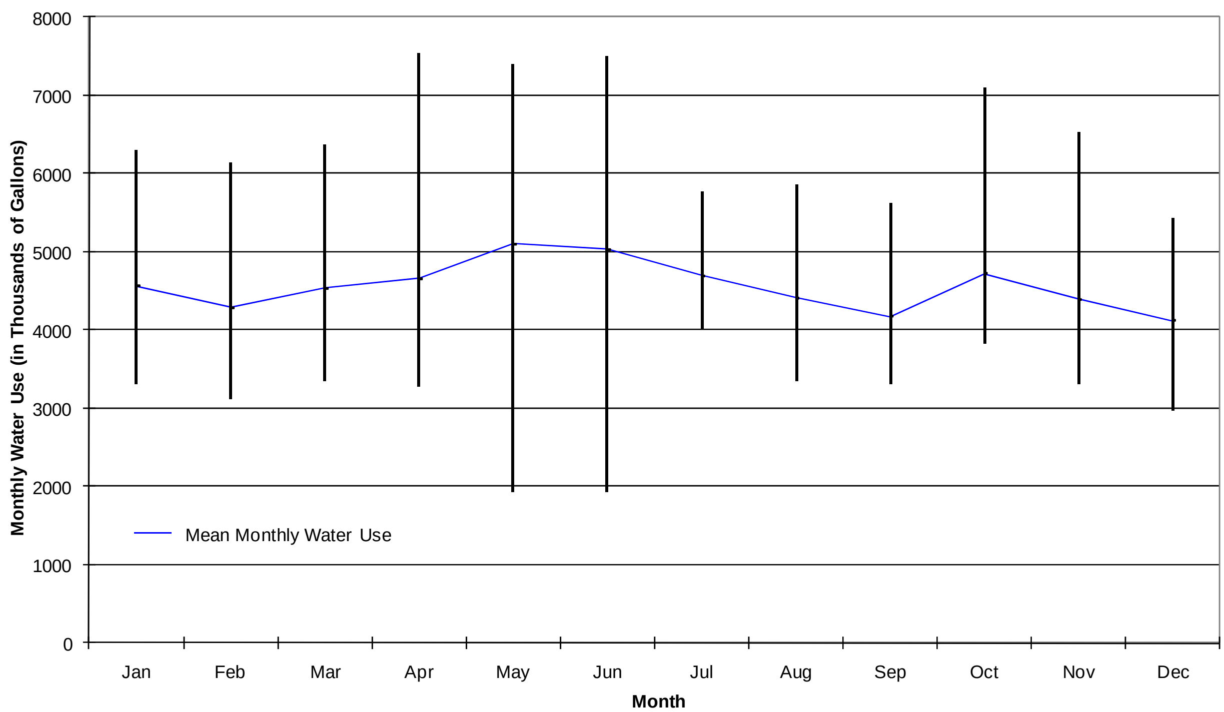


**Figure 4 - Town of Greenville Water Works Monthly Water Use 2000 through 2008**

**Table 2 - Town of Greenville Water Works Monthly Water Use Statistics (1999 -2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 1,920 | 7,540 | 4,560 |
| (cfs) | 0.0990 | 0.3890 | 0.2320 |
| (cfsm at impact point) | 0.0026 | 0.0100 | 0.0060 |
| (cfsm at Merrimack Gage) | 0.0006 | 0.0023 | 0.0014 |

**Env-Wq 2101 Requirements for Water Conservation Plan**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Conservation Rules require different activities depending on the type of water use. Conservation plans for public water supplies require inclusion of the following components:

- Installation, maintenance, and use of appropriately selected meters;
- Maintaining low levels of unaccounted-for water;
- Performing water audits to assess losses;
- A comprehensive plan for leak detection surveys of the distribution system;
- System pressure reduction, as necessary;
- A water conservation educational outreach initiative;
- Adopting a rate structure that promotes water conservation; and,
- On-going water conservation compliance reporting.

Greenville Water Works will be in compliance with the water conservation plan requirements of the Instream Flow Program by completing a Water Conservation Plan and receiving approval on it from the DES Groundwater and Drinking Water Bureau.

**Existing Water Conservation Measures**

Greenville Water Works has implemented several of the water conservation measures recommended by DES for water utilities and required in the state's Water Conservation Rules (Env-Wq 2101) for existing large community water systems. The water source (water treatment plant for Tobey Reservoir) is metered and the meters are tested every six months, and are calibrated if they do not meet their operational requirements. Service meters are tested if users have questions regarding their recorded water use or if they are identified as high usage water users. Water is priced at a flat rate per 1,000 gallons that Greenville Water Works believes supports water conservation. Water bills are issued on a semi-annual basis, which limits the detection of service line leaks. Greenville is planning on replacing the existing water meters with wireless recording meters and may consider changing the billing schedule.

Greenville does not have a formal leak detection plan in place, but the Water Works responds to individual leakage problems and checks any services with increasingly high water use. Greenville has replaced some of their water distribution piping system, which appears to have contributed to a reduction in water use (Figure 3). The minimum system water pressure is 35 psi, while the maximum water pressure is 125 psi. Homes with water pressure greater than 80 psi have pressure regulators.

Greenville writes an annual consumer confidence report, which includes conservation educational material, and mails the report to water users and makes the report publicly available by it posting at the town hall.

**Water Conservation Alternatives and Costs**

The existing water conservation measures employed by Greenville Water Works should be expanded to include measures to better identify water losses and to increase water use efficiency, along with providing greater access to information on water conservation. As required under by the Water Conservation Rules for existing large community water systems (Env-Wq 2101.05) the Town will determine its unaccounted-for water use annually. If the amount of unaccounted-for water use exceeds 15 percent, a response plan will be submitted to DES within 60 days. The response plan will identify how the water system will reduce the percentage of unaccounted for water below 15 percent within two years. In addition, a regularly scheduled leak detection program should be developed and implemented for the system to identify water losses. Water conservation educational outreach will be increased by posting information on water conservation and efficiency practices on the Town's web site to provide reference information for water users.

If the Town needs to implement or maintain more restrictive water conservation measures due to diminished supply from its source(s) or storage, then those actions take precedent over this Conservation Plan. Nothing in this Plan precludes the Town from further conservation actions on its own initiative.

**Conservation Implementation Schedule**

By June 1, 2014, Greenville Water Works will finalize a Water Conservation Plan as required by Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers. The Plan will document compliance with the requirements for Existing Large Community Water Systems (Env-Wq 2101.05) and will be administered by the DES Drinking Water and Groundwater Bureau under the authority of the Instream Flow Program.

**Water User Contact Information**

**Water User**: Town of Greenville
**Address**: P.O. Box 343, Greenville, NH 03048
**Contac**t: Carla Mary
**Phone**: 878-1338
**Email**: cmary@woodardcurran.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
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## Sources of Information


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

Department of Environmental Services (DES) 1998. Developing a Utility Water Conservation Program. Environmental Fact Sheet WD-WSEB-6-1.

Department of Environmental Services (DES) 2001. Implementing a Water Efficiency and Conservation Program for Public Water Utilities. Environmental Fact Sheet WD-WSEB-26-9.

Personal communication with Carla Mary, Woodard and Curran, contractor for the Town of Greenville.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed with input from Carla Mary, Woodard and Curran, contractor for the Town of Greenville.

Woodard & Curran, Inc. 2009. Town of Greenville Water Treatment Facility Emergency Action Plan.

Water use reports on file with the Department of Environmental Services (DES).

# CONSERVATION PLAN

## Milford Fish Hatchery (#20218)

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

The New Hampshire Fish and Game Department Milford Fish Hatchery has two overburden water supply wells located north of the Souhegan Designated River and west of the Milford Town center. The wells are accessed off of North River Road in Milford, New Hampshire. The water pumped from these wells is the source water for the hatchery, which raises trout for stocking in New Hampshire streams.

### Water Source and Uses

The Milford Fish Hatchery has two registered ground water wells, Well #4 (20218-S01, also known as the River Well) and Well #1 (20218-S02, also known as the Field Well). Much of the water used by the fish hatchery is returned to the Souhegan Designated River via an outfall (20218-D01) into Purgatory Brook, a tributary to the Souhegan. Figure 1 depicts the location of

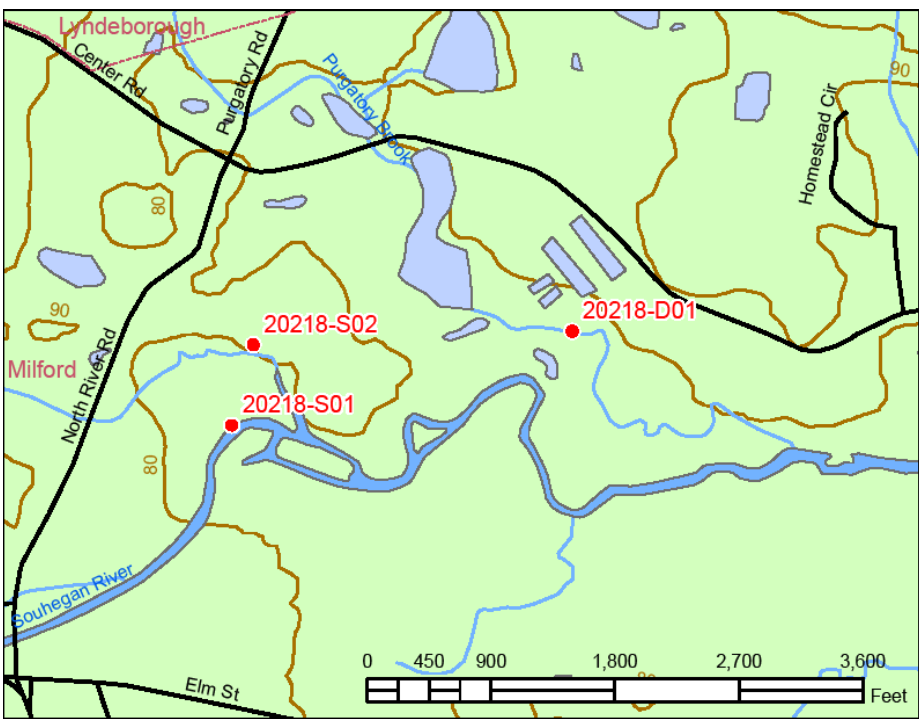


**Figure 1 - Location of the Milford Fish Hatchery Withdrawals (S01 and S02) and Discharge (D01) in Relation to the Souhegan River**

the wells and outfall. The overburden wells are 273 feet (River) and 668 feet (Field) from the Souhegan Designated River. The drainage area of the Souhegan River at the location of these wells is approximately 117 sq. mi.

Groundwater is withdrawn almost continuously since the wells are the water supply source for the fish hatchery and fish are cultivated year round. A separate water supply well is used to provide potable water to the hatchery facility. There is no reserve water storage at the fish hatchery.

Although the water source is groundwater, due to the fact that these wells are located in a stratified drift formation that is connected to the Souhegan Designated River, the wells intercept water that would be flowing into or just beneath the river. An analysis of induced recharge for these wells indicates that for average pumping rates, the River Well induces 22 percent of its extraction from the river and the Field Well induces 35 percent of its extraction from the river.

**Water Use Patterns**

Water use is continuous and supports the needs of the aquaculture production at the fish hatchery. The groundwater pumped from the aquifer is free of fish pathogens, thereby limiting the potential for disease, and its nearly constant temperature provides cooling conditions for the fish in the summer and warmth during the winter.

The River Well (20218-S01) is pumped at a constant rate of 1,100 gallons per minute (gpm), while the Field Well (20218-S02) pumping rate varies between 400 and 800 gpm. Groundwater pumping is metered, recorded weekly and reported quarterly to DES.

Milford Fish Hatchery withdrawals for 1988 through 2008 are presented graphically in Figures 2, 3, and 4, while annual water use statistics are summarized in Tables 1, 2, and 3. The first complete year of reported use was 1989. These tables include the conversion of annual water use from thousands of gallons to cubic feet per second (cfs) and cubic feet per square mile (cfsm) of drainage area to allow for their comparison with streamflow values reported for the Souhegan Designated River.

Between 1989 and 2008, annual pumpage from the Milford Fish Hatchery wellfield ranged from a high of 1,030 million gallons (2000) to a low of 236 million gallons (1992), and average use was 803 million gallons (Figure 2 and Table 1). During this period, water use increased from 1989 to 1999, but then stabilized around 900 million gallons per year (Figure 2). From 1989 through 2008, water use increased by 357 million gallons or 67 percent. This represents an increase of 17.8 million gallons a year or 3.3 percent a year over the 20 year period.

The flattening of annual water use beginning in the early 2000s is due to the implementation of a stable production target of trout for fisheries management in southwestern New Hampshire rivers. There are no plans to expand production at this time, and annual water use is not expected to increase in the near future.

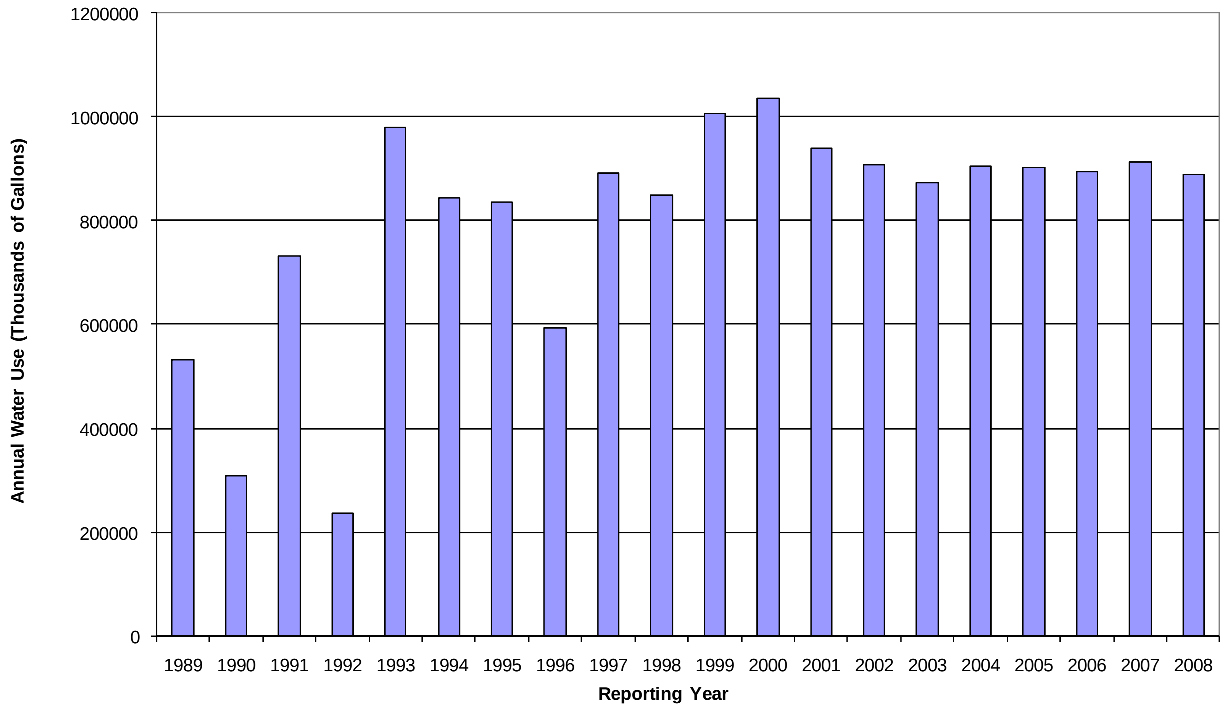


**Figure 2 - Milford Fish Hatchery Annual Water Use 1989-2008**

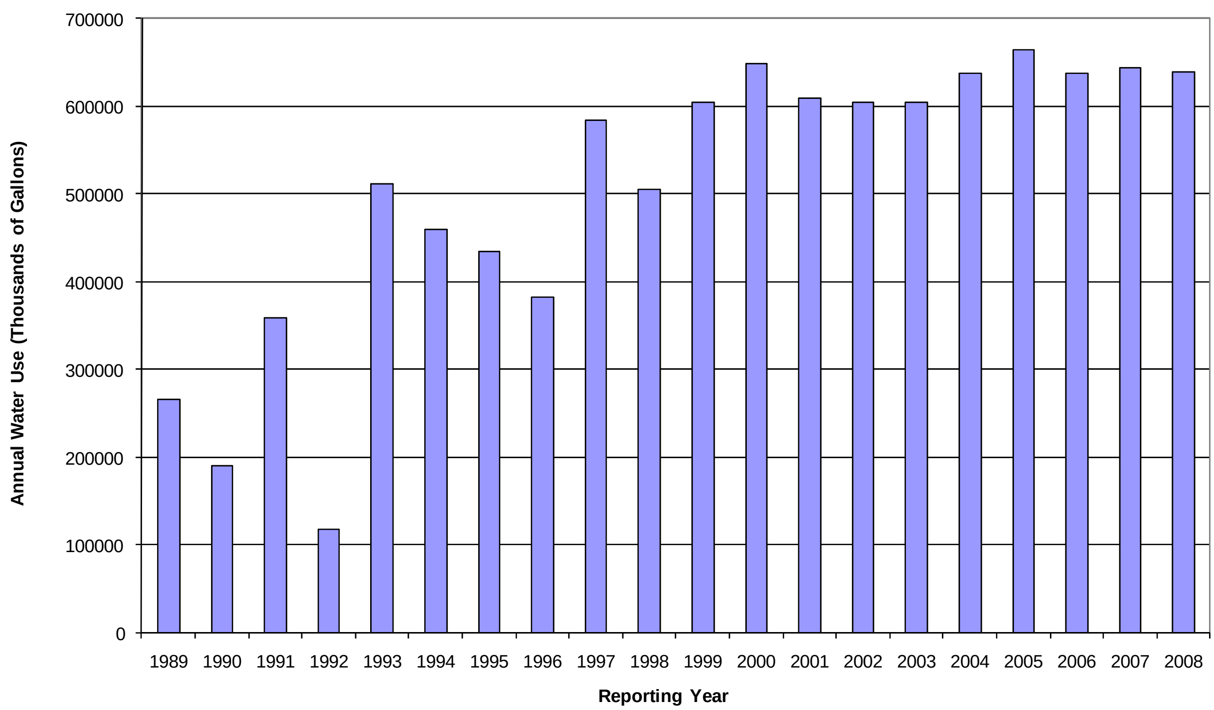


**Figure 3 - Milford Fish Hatchery River Well Annual Water Use 1989-2008**

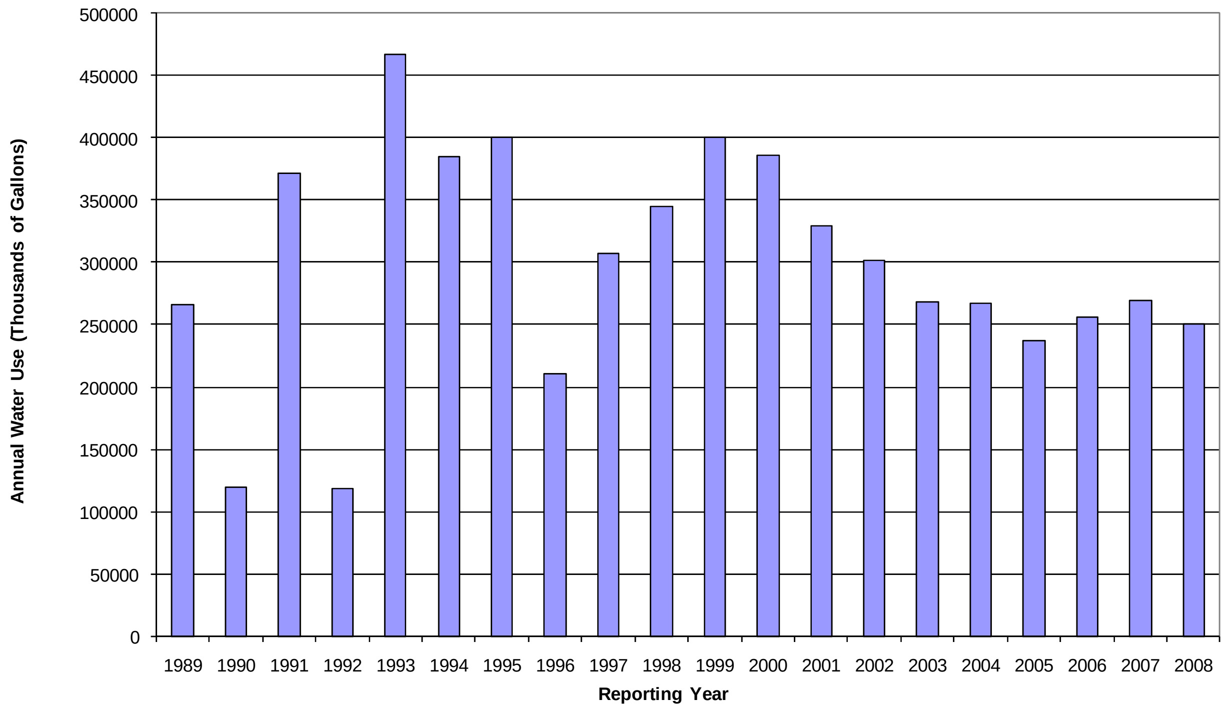


**Figure 4 - Milford Fish Hatchery Field Well Annual Water Use 1989-2008**

**Table 1 - Annual Water Use Statistics (Combined Wells 1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 236,000 | 1,030,000 | 803,000 |
| **(cfs)** | 1.000 | 4.390 | 3.410 |
| **(cfsm at impact point)** | 0.009 | 0.037 | 0.029 |
| **(cfsm at Merrimack Gage)** | 0.006 | 0.026 | 0.020 |

**Table 2 - Annual Water Use Statistics (River Well 1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 118,000 | 663,000 | 505,000 |
| **(cfs)** | 0.500 | 2.820 | 2.140 |
| **(cfsm at impact point)** | 0.004 | 0.024 | 0.018 |
| **(cfsm at Merrimack Gage)** | 0.003 | 0.016 | 0.013 |

**Table 3 - Annual Water Use Statistics (Field Well 1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 118,000 | 663,000 | 505,000 |
| **(cfs)** | 0.500 | 2.820 | 2.140 |
| **(cfsm at impact point)** | 0.004 | 0.024 | 0.018 |
| **(cfsm at Merrimack Gage)** | 0.003 | 0.016 | 0.013 |

Monthly water use records for the Milford Fish Hatchery begin in October 1988. Average monthly water use varies in a narrow range (Figures 5, 6, and 7), but follows seasonal trends. This seasonal variation reflects the growing season pattern, fish biomass, and the water needs for loading capacity. Higher water use during the late winter (March) coincides with the peak of fish biomass at the hatchery. Fish are distributed out of the facility from April through June, resulting in a lower biomass and lower water use. The next generation (year-class) of trout grows from July to September, with a concurrent increase in biomass, and the growth corresponds with an increase in water use.

The high variability (maximum versus minimum) in monthly water use shown in Figures 5, 6, and 7 is related to the period of increasing use from 1988 to 1999. Since 1999, the variability in annual water use along with monthly water use has lessened considerably due to a more stable production target of trout. Monthly water use statistics are shown in Tables 4, 5, and 6. The highest total monthly water use by the fish hatchery wells was 1,104 million gallons (December 2000), the lowest total monthly use was 3.24 million gallons (November 1991), with an average monthly use of 73.4 million gallons (Figure 5 and Table 4).

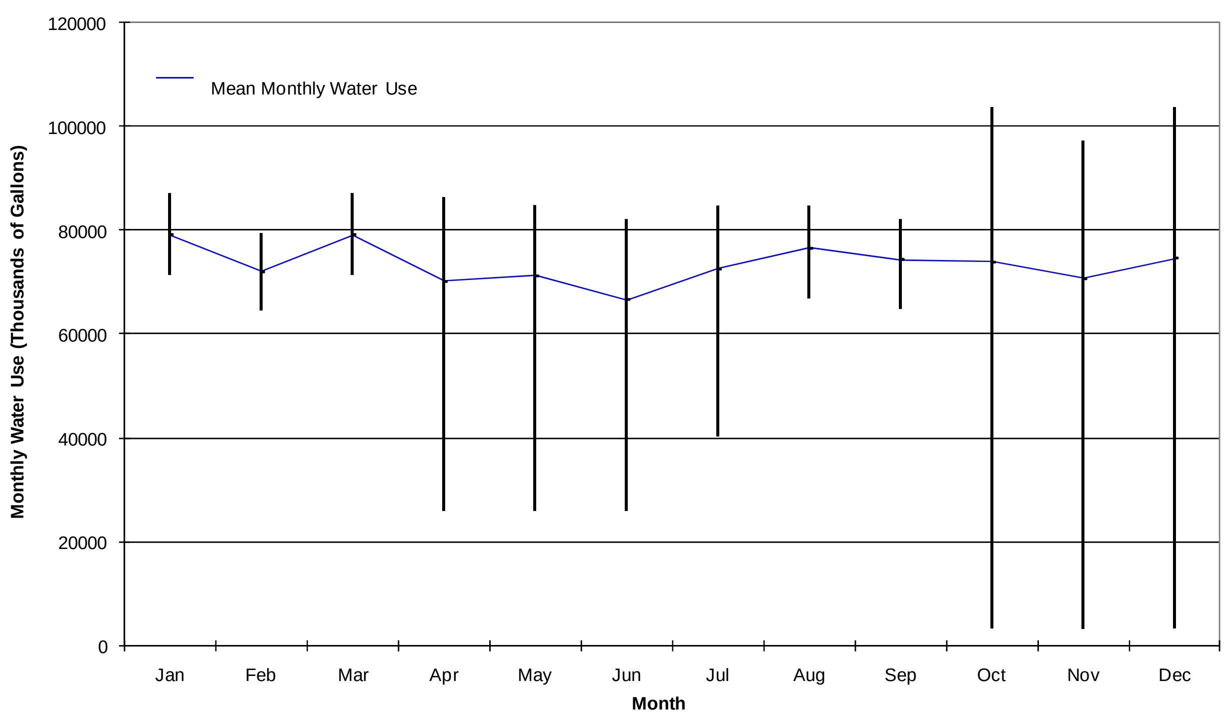


**Figure 5 - Milford Fish Hatchery Monthly Water Use 1988-2008**

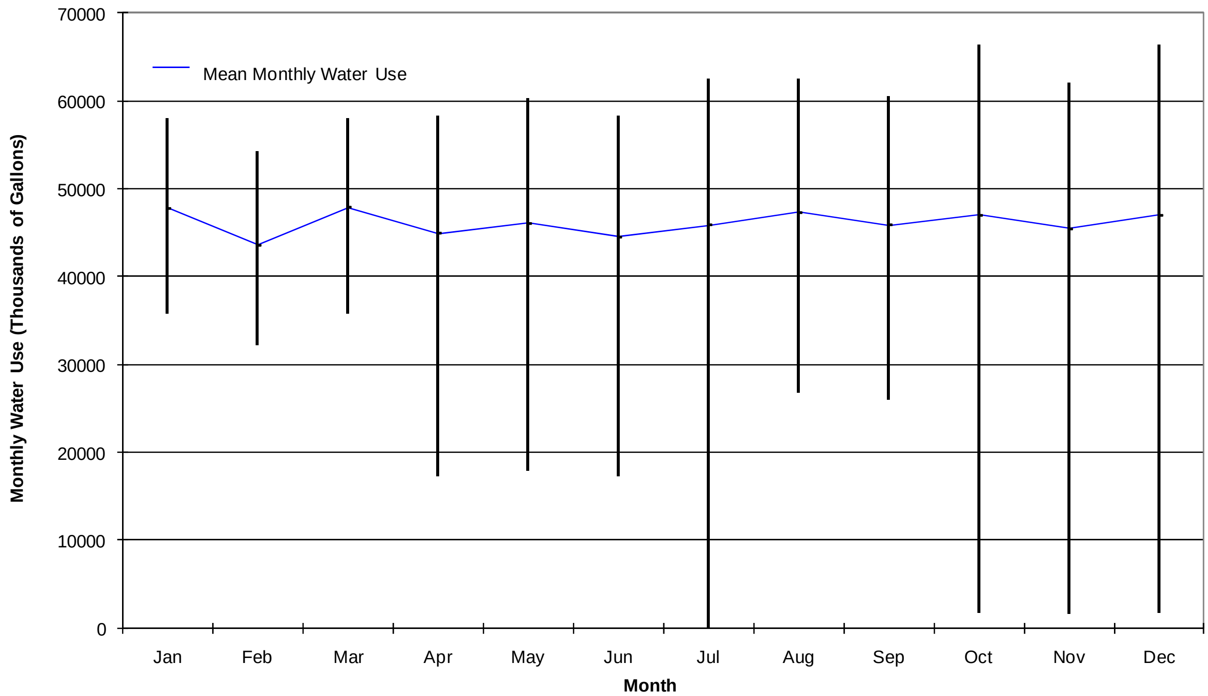


**Figure 6 - Milford Fish Hatchery River Well Monthly Water Use 1988-2008**

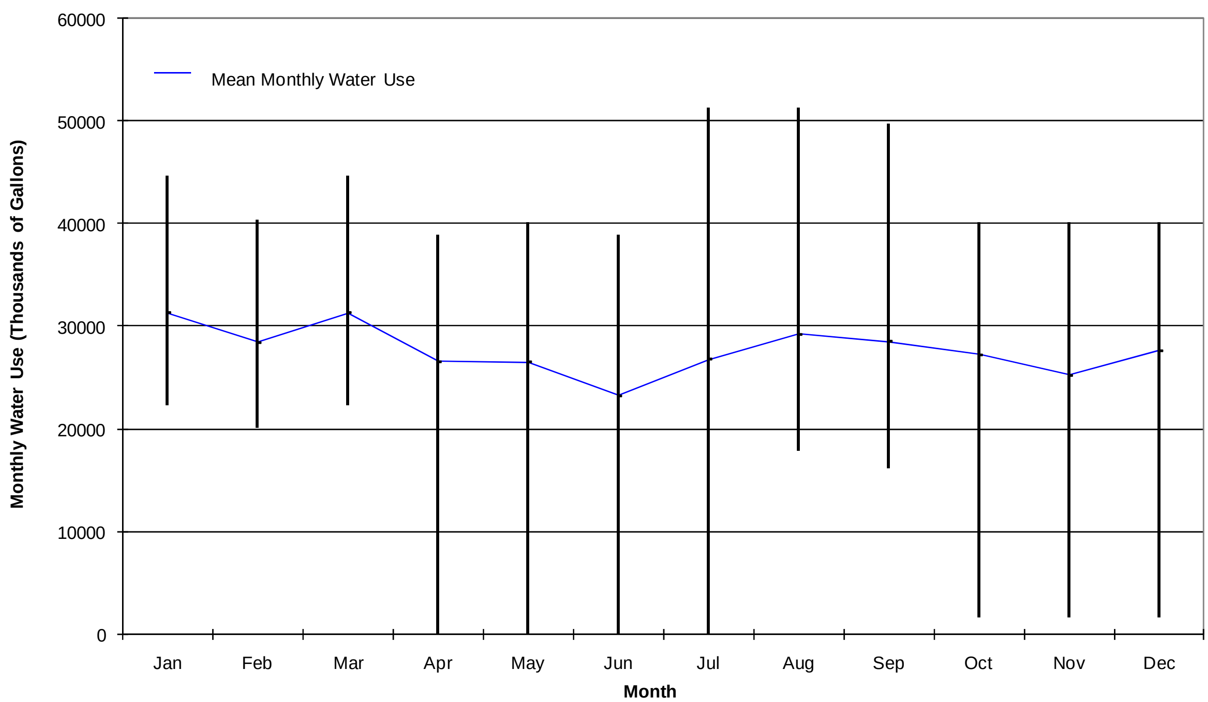


**Figure 7 - Milford Fish Hatchery Field Well Monthly Water Use 1988-2008**

**Table 4 - Monthly Water Use Statistics (Combined Wells 1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 3,240 | 104,000 | 73,400 |
| **(cfs)** | 0.167 | 5.190 | 3.740 |
| **(cfsm at impact point)** | 0.001 | 0.044 | 0.032 |
| **(cfsm at Merrimack Gage)** | 0.001 | 0.030 | 0.022 |

**Table 5 - Monthly Water Use Statistics (River Well 1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 66,300 | 46,000 |
| **(cfs)** | 0 | 3.310 | 2.340 |
| **(cfsm at impact point)** | 0 | 0.028 | 0.020 |
| **(cfsm at Merrimack Gage)** | 0 | 0.019 | 0.014 |

**Table 6 - Monthly Water Use Statistics (Field Well 1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 51,300 | 27,600 |
| **(cfs)** | 0 | 2.560 | 1.410 |
| **(cfsm at impact point)** | 0 | 0.028 | 0.020 |
| **(cfsm at Merrimack Gage)** | 0 | 0.015 | 0.008 |

Monthly water use data for the Milford Fish Hatchery were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor  These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gage station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire, and were also normalized to the drainage area (117 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the average daily water use by the Milford Fish Hatchery has ranged from a minimum of 0.167 cfs (107,935 gallons per day, November 1991) to a maximum of 5.19 cfs (3.35 million gallons per day, December 2000), and average use was 3.74 cfs (2.4 million gallons per day) for the period of 1988 to 2008 (Table 4).

**Env-Wq 2101 Requirements for Water Conservation Plan**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules.  The Water Conservation Rules require different activities depending on the type of water use.  Water conservation requirements for agricultural water users focus more on crop irrigation and farm animals as opposed to aquaculture.  At a minimum, Milford Fish Hatchery is required to measure each source withdrawal separately, measure its water use with accuracy within 10 percent, and implement applicable best management practices.

## Existing Water Conservation Measures

The Milford Fish Hatchery is a vintage (1973) facility, with a few recent modifications for improved function. Since it is not a modern re-circulation hatchery, many of the water efficiency practices recommended by DES are impractical for the design of the existing facility. However, the hatchery has implemented several basic water conservation practices, including:

- metering the water supply wells;
- performing water use and conservation audits;
- determining and monitoring the minimum flow rates needed to maintain temperature and dissolved oxygen conditions;
- installing weirs and recording flow measurements;
- minimizing water use for tank and facility washing;
- repairing pipes and tanks to minimize leaks;
- establishing a routine maintenance program; and,
- reusing water as much as possible.

## Water Conservation Alternatives and Costs

Without major modifications in the design of the facility, the potential for the implementation of additional water conservation measures is limited. The Milford Fish Hatchery should develop and implement a meter testing and calibration program for the two water supply wells to ensure the accurate measurement of water use. The estimated cost for meter testing is approximately $2,000. Calibration, if necessary, would be an additional cost ranging from $600 to $1,200 for both meters. At a minimum, the water meters should be tested every two years.

In addition, the facility should directly measure discharge from the facility so that water balance calculations can be performed to identify systematic water losses (or gains). These measurements should be made at the discharge point from the holding tanks and into the holding pond.

## Conservation Implementation Schedule

By June 1, 2014, the Milford Fish Hatchery will finalize a Water Conservation Plan in accordance with Env-Wq 2101 in order to meet the Instream Flow Rule (Env-Wq 1900) requirements for a conservation plan. The Water Conservation Plan will document the Milford Fish Hatchery's existing water conservation activities, maintenance of the source water meters in accordance with the provisions of the Water Conservation Rules, and use of water conservation best management practices and best available technologies where economically feasible.

## Water User Contact Information

**Water User**: New Hampshire Fish and Game Department
**Address**: 408 North River Road, Milford, NH 03055
**Contact**: Jason Smith
**Phone**: 271-2501
**Email**: Jason.Smith@Wildlife.nh.gov

## Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

## Sources of Information


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

Department of Environmental Services (DES) 2010. Water Efficiency Practices for Aquaculture. Environmental Fact Sheet WD-DWGB-26-12.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc.

Water use reports on file with the Department of Environmental Services (DES).

## CONSERVATION PLAN

### Milford Water Works (#20100)

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

The Milford Water Works has two overburden water supply wells located north of the Souhegan Designated River in the neighboring town of Amherst, New Hampshire. While the Curtis Wellfield is the principal source of drinking water for the Town of Milford, the community also has an interconnection with Pennichuck Water for additional water.

### Water Source and Uses

The Milford Water Works supply source consists of three wells, Curtis Wells #1, #2 and #2A as a wellfield under one registration (20100-S01). Figure 1 depicts the location of the registered combined withdrawal with respect to the Souhegan Designated River. These overburden wells are 213 feet, 74 feet and 98 feet from the Souhegan River. The drainage area of the Souhegan River at the location of these wells is approximately 139 sq. mi.

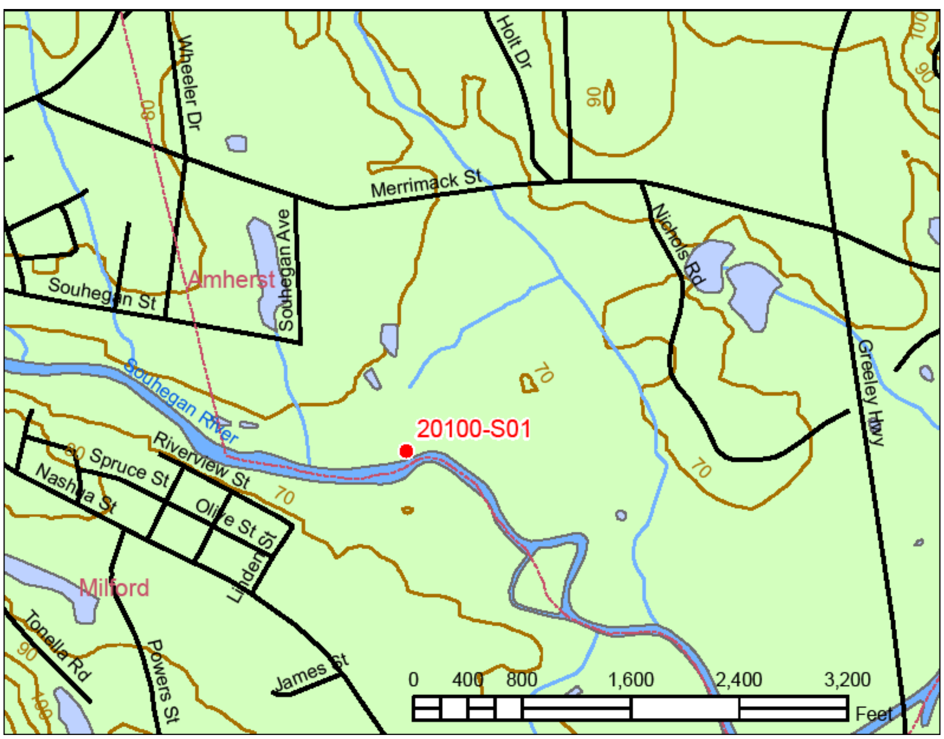


**Figure 1 - Location Map of Milford Water Works Well Field, Amherst, New Hampshire**

Groundwater is withdrawn continuously from the wells since the water is the principal water supply for the Town of Milford. When demand exceeds supply from the wellfield, the Town purchases additional water from the Pennichuck Water distribution system. In 2008, the Curtis Wells supplied 88.6 percent of the water needed and the remaining 11.4 percent was purchased from Pennichuck Water. The Town water system also includes 1.25 million gallons of storage.

The Town of Milford has also applied to DES for approval of a new drinking water supply well for their system. The new well (Curtis Well #2A) is being developed as a backup to the existing Well 2 at the Curtis Wellfield. Well 2 has declined in specific capacity in recent years and this backup well will allow for full utilization of the wellfield production.

Although the water source is groundwater, because these wells are located in a stratified drift formation connected to the Souhegan River, the wells intercept water that would be flowing into or just beneath the Souhegan River. An analysis of induced recharge by these wells was performed as part of the Instream Flow Study (DES 2005). The results of the analysis indicated that Curtis Well #1 does not induce Souhegan River water recharge at its average or maximum reported extraction rates. However, approximately 60 percent of the Curtis Well #2 extraction is induced recharge for its long-term average pumping rate.

**Water Use Patterns**

Water use is continuous and the Curtis Wells provide sufficient water to supply most of the community water supply needs. The wells are pumped at a uniform rate of 700 gallons per minute (gpm). When pumping exceeds demand, excess water fills storage, and when pumping is less than demand, stored water makes-up the difference. Groundwater pumping is metered, recorded monthly, and reported to DES quarterly.

Water use data for the Milford Water Works for 1988 through 2008 are summarized in Figures 2 and 3 as well as in Tables 1 and 2. Unfortunately, each well does not have its own meter and therefore the withdrawal data are for the combined well pumping. Water use records were incomplete for 1988, so are not included in the annual use summaries. The first complete year of water use was reported for 1989.

Between 1989 and 2008, annual pumpage from the Curtis Wellfield ranged from a high of 374 million gallons (1998) to a low of 211 million gallons (1990), and average use was 307 million gallons (Figure 2 and Table 1). During this period, annual water use from the Curtis Wellfield increased by 87.6 million gallons or 36.2 percent. This represents an increase of 4.4 million gallons a year or 1.8 percent per year over the 20 year period. As shown in Figure 2, water use increased from 1989 to its maximum in 1998 and since then has ranged from 305.9 million gallons (2006) to 364.4 million gallons (2007). The plateau in water use reflects the supply limitation of the Curtis Wellfield and a contracted cap on the water available from Pennichuck Water. As a result, the Town of Milford is exploring the development of an additional water supply well for the system.

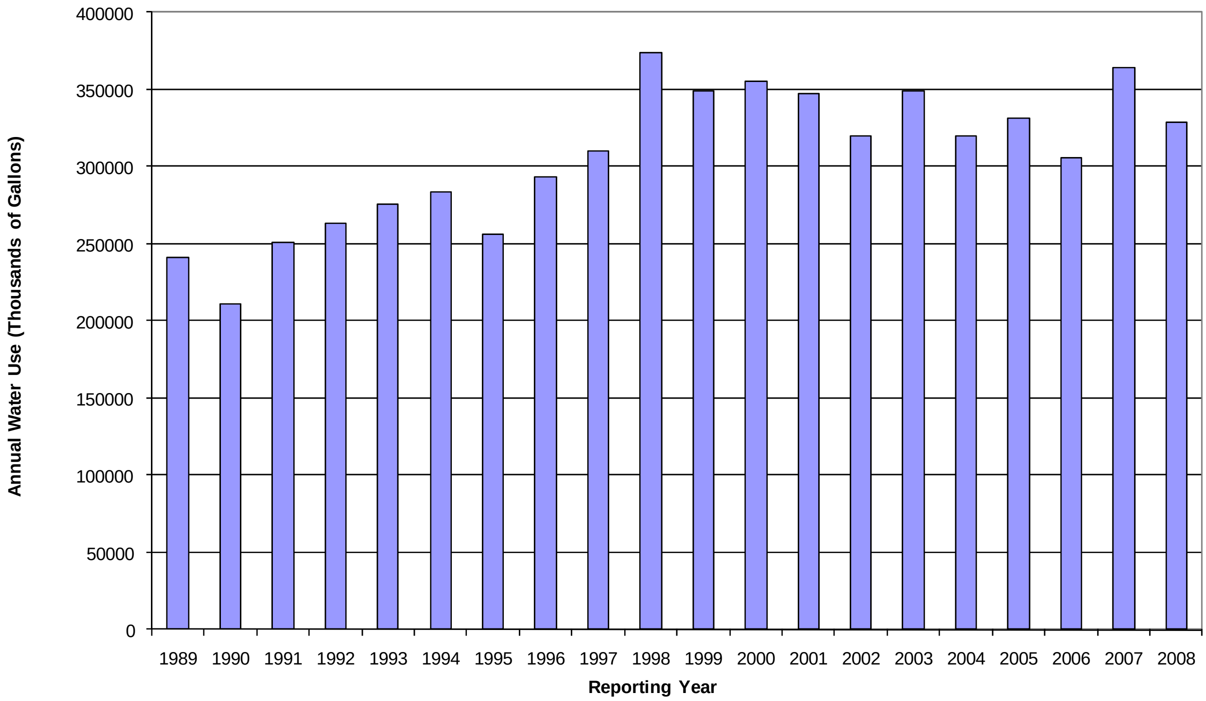


**Figure 2 – Milford Water Works Annual Water Use, 1989-2008**

**Table 1 – Milford Water Works Annual Water Use Statistics (1989 - 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 211,000 | 374,000 | 307,000 |
| **(cfs)** | 0.894 | 1.590 | 1.300 |
| **(cfsm at impact point)** | 0.006 | 0.011 | 0.009 |
| **(cfsm at Merrimack Gage)** | 0.005 | 0.009 | 0.008 |

Monthly water use records for the Curtis Wellfield begin in October 1988. Monthly water use varies in response to weather conditions and changes in seasonal demand. The total and average monthly water usage is highest during the summer and lowest during winter. This seasonal pattern reflects increased outdoor water usage (lawn irrigation, garden watering, vehicle washing, etc.) during the summer months, which declines during the fall, remains low during the winter, and begins to increase again in the spring. The highest total monthly use for the Curtis Wellfield was 38.4 million gallons (August 2006) and the lowest total monthly use was 8.41 million gallons (March 2002), with an average monthly use of 25.5 million gallons (Figure 3 and Table 2).

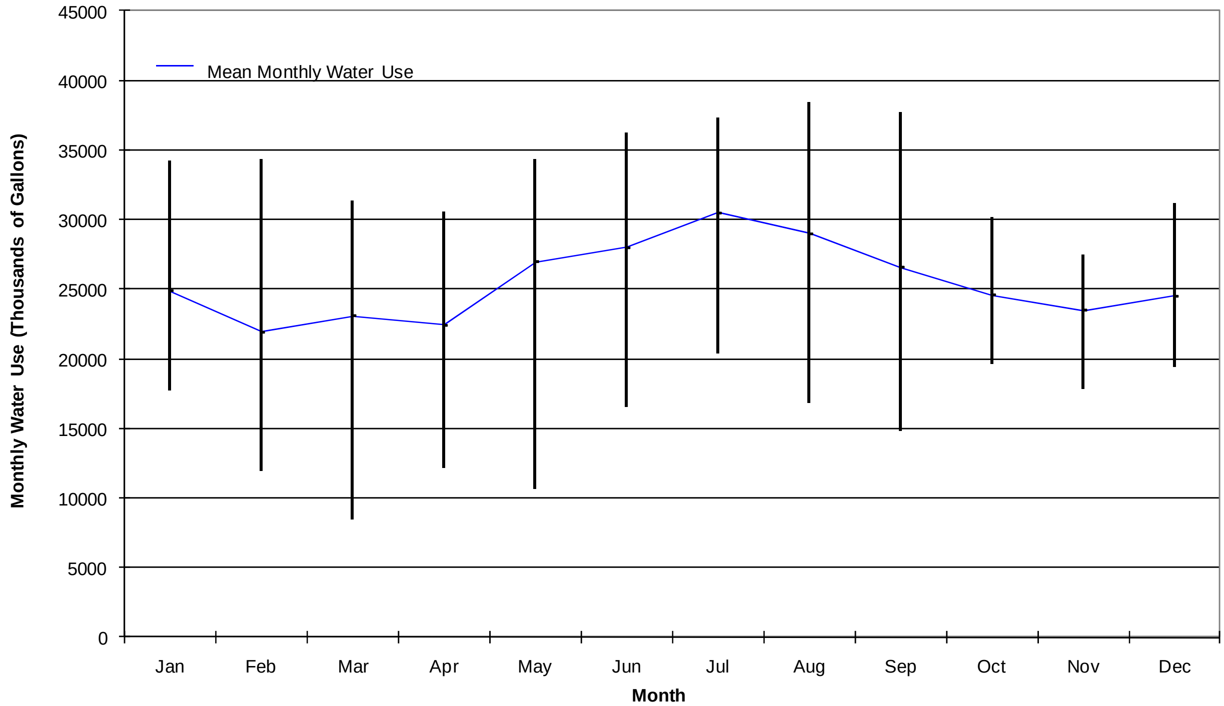


**Figure 3 – Milford Water Works Monthly Water Use 1989 through 2008**

**Table 2 – Milford Water Works Monthly Water Use Statistics (1988 - 2008).**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 8,410 | 38,400 | 25,500 |
| **(cfs)** | 0.420 | 1.920 | 1.300 |
| **(cfsm at impact point)** | 0.003 | 0.014 | 0.009 |
| **(cfsm at Merrimack Gage)** | 0.002 | 0.011 | 0.008 |

Monthly water use data for the Curtis Wellfield were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor.  These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gage station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire, and they were also normalized to the drainage area (139 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the average daily water use for the Curtis Wellfield has ranged from a minimum of 0.42 cfs (271,454 gallons per day, March, 2002) to a maximum of 1.92 cfs (1.24 million gallons per day, August, 2006), and average use was 1.30 cfs (840,216 gallons per day) for the period of 1988 to 2008 (Table 2).

**Env-Wq 2101 Requirements for Water Conservation Plan**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Conservation Rules require different activities depending on the type of water use. Conservation plans for public water supplies require inclusion of the following components:

- Installation, maintenance, and use of appropriately selected meters;
- Maintaining low levels of unaccounted-for water;
- Performing water audits to assess losses;
- A comprehensive plan for leak detection surveys of the distribution system;
- System pressure reduction, as necessary;
- A water conservation educational outreach initiative;
- Adopting a rate structure that promotes water conservation; and,
- On-going water conservation compliance reporting.

Milford Water Works will be in compliance with the water conservation plan requirements of the Instream Flow Program by completing a Water Conservation Plan and receiving approval on it from the DES Groundwater and Drinking Water Bureau.

**Water Conservation Measures**

Milford Water Works has implemented metering of all private users, including automated residential water meters. The Curtis Well water meters are tested annually and calibrated as necessary. Milford Water Works does not routinely test commercial or residential meters, but will provide a meter check if high water use is recorded.

Estimated unaccounted-for water use has been as high as approximately 21 percent of total water pumped. This value includes losses due to hydrant flushing, fire fighting and water breaks, and may overstate actual unaccounted-for water use. Unaccounted-for water use will be re-estimated with recalibration of the source wells.

During the summer of 2010, 15 miles of water distribution lines were surveyed for leaks and only one notable leak was discovered. Milford Water Works has also upgraded its leak detection equipment and plans on continuing the leak detection surveys annually.

Milford Water Works does not have to perform pressure reduction in its water distribution system. The Town charges a flat rate for water.

Information on water conservation is available through the Town’s website and is broadcast on the community cable television channel. Information on water conservation is also distributed to water users in mailings.

**Water Conservation Alternatives and Costs**

Approval of the attached Water Conservation Plan (dated August 2011) by DES Drinking Water and Groundwater Bureau meets the Instream Flow Program's Conservation Plan requirements. The Water Conservation Plan will be administered by the Drinking Water and Groundwater Bureau under their existing authority or the authority of the Instream Flow Program.

**Conservation Implementation Schedule**

The Town will continue to implement its Water Conservation Plan (dated August 2011). The first three-year compliance report from the Town of Milford to the DES Drinking Water and Groundwater Bureau is due in 2014.

**Water User Contact Information**

**Water User**: Milford Water Works
**Address**: Town Hall, 1 Union Square, Milford, NH 03055-4240
**Contact**: Dave Boucher, Superintendent
**Phone**: 249-0660
**Email**: dboucher@milford.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

Department of Environmental Services (DES) 1998. Developing a Utility Water Conservation Program. Environmental Fact Sheet WD-WSEB-6-1.

Department of Environmental Services (DES) 2001. Implementing a Water Efficiency and Conservation Program for Public Water Utilities. Environmental Fact Sheet WD-WSEB-26-9.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Mr. Larry Anderson, superintendent of the Town of Milford Water Utilities Department.

Water use reports on file with the Department of Environmental Services (DES).

# <u>WATER CONSERVATION PLAN</u>

Prepared Pursuant to

NHDES Administrative Rule Env-Wq 2100,
*Water Conservation Rules; Use Registration and Reporting*

As Required for a Proposed

**0.58 MGD Municipal Water Supply Well**
**Curtis Well # 2A**

**Milford Water Utilities Department**

**Milford, New Hampshire**

August, 2011

# Milford Water Utilities Department,
# Milford, NH

# Curtis Well # 2A
# Water Conservation Plan

## I. INTRODUCTION

The Milford Water System provides domestic water and fire protection to the residents and businesses in Milford, New Hampshire. The water system consists of 2 (two) gravel wells, well pump house, distribution piping and water storage tanks. A new gravel packed well is currently being installed as a back up to Well No. 2. The Final Report for Well No. 2A was submitted to NHDES on 8/5/2011.

### *A. Contact Information*

1. *Name and location of system.*

   Milford Water Utilities Department
   EPA PWID # 1561010
   Milford, NH 03055

2. *Owner of system and mailing address.*

   Name: David Boucher, Superintendent.
   Address: 564 Nashua Street, Milford, NH 03055
   Company: Milford Water Utilities Department
   Phone Number: 603-249-0660 FAX: 603-672-1071
   Email: dboucher@milford.nh.gov

3. *Name and mailing address of designer of Water Conservation Plan.*

   Name: James Hewitt, P.E., Project Engineer
   Address: 230 Commerce Way, Suite 302, Portsmouth, NH
   Company: Wright-Pierce
   Phone Number: 603-430-3728 FAX: 603-430-4083
   Email: jah@wright-pierce.com

In accordance to NHDES Administrative Rule Env-Wq 2100, "*Water Conservation; Use Registration and Reporting*", effective May 13, 2005, (formerly Env-Ws 390) the Milford Water Utilities Department will conduct the following water conservation measures subsequent to approval of the proposed 0.58 MGD well (Curtis Well # 2A).

B. System Overview

1. Reason for new source.

**Curtis Well 2A is being developed as a new source to serve as a backup to existing Well 2 at the Curtis Wellfield. Well 2 has declined in specific capacity in recent years and backup Curtis Well 2A will allow for full utilization of the Curtis Wellfield's permitted total daily volume (1400 gpm).**

2. Number of existing and proposed connections for each of the following classes:

a) Residential;

**2,204**

b) Industrial/commercial/institutional; and

**529**

c) Municipal.

**Included in municipal customer count**

*3. Description of any connections that currently receive or will receive more than 20,000 gpd.*

**There are currently no connections that receive greater than 20,000 gpd**

*C. Water Use Trends and Supporting Data / Population Trends:*

*3. Existing and anticipated seasonal fluctuation in population.*

**Milford has minimal population fluctuation throughout the year. We do not anticipate this changing significantly in the future.**

*4. Anticipated growth in population.*

**1.8% per year based on prior billing records**

**5.** *Maximum day yield of existing sources based on 24-hour pumping.*

**1.584 MGD**

*6. Average daily water use.*

**0.924 MGD**

7. *Maximum daily water use.*

**1.26 MGD**

*8. Minimum hourly flows (if available).*

**N/A**

## II. SYSTEM SIDE MANAGEMENT

### *A. Source Meters*

1. Name designation of each water source.

**Curtis Well Field Wells and Pennichuck Water Works Interconnection.**

2. Meter make, model, size, flow range, and date of last calibration for each existing water source.

| **Meter Parameter** | **Curtis Well Field Wells** | **Pennichuck Water Works Interconnection** |
|---|---|---|
| **Make** | **Badger** | **Neptune** |
| **Model** | **PMT-I** | **HPT** |
| **Size** | **8"** | **6"** |
| **Flow range** | **0-1250 gpm** | **20-2500 gpm** |
| **Date of last calibration** | **8/4/10** | **Meter is replaced with a new meter annually. Last install: 1/5/11** |

3. Meter make, model, size, and flow range of each proposed source meter (if known).

**Proposed Well 2A will be metered using the existing Curtis Well Field Wells flow meter.**

4. Frequency that source meters will be tested.

**Annually**

5. Frequency that source meters will be read (at least every 30 days).

**Curtis Well Field Wells Meter: Daily**

**Pennichuck Water Works Interconnection: Weekly**

6. Statement that source meters will be selected, installed, and maintained in compliance with "Manual of Water Supply Practices, Water Meters-Selection, Installation, Testing, and Maintenance," document identification number AWWA M6, American Water Works Association, 1999.

**All source meters will be selected, installed and maintained with the procedures and protocols described in the "Manual of Water Supply Practices, Water Meters-Selection, Installation, Testing and Maintenance", document identification number AWWA M6, American Water Works Association, 1999.**

B. *Service Meters*

1. How many un-metered connections exist?

**Zero**

2. Proposed timeframe for installing meters on unmetered connections (no later than within three years of source water approval).

**N/A**

3. Will separate irrigation meters be installed?

**Offered upon request.**

4. Frequency that service meters will be read (at least every 90 days).

**Every 90 Days**

5. Description of all methods that will be used to read service meters.

**The meters are read using a Neptune AMR system.**

6. Expected number of days needed to read all service meters.

**It takes approximately 8 days to read all service meters**

7. Statement that all service connections will be metered prior to system startup.

**All service connections will be metered prior to system start up. All services are current metered.**

8. Statement that service meters will be selected, installed, and maintained in accordance with "Manual of Water Supply Practices, Water Meters-Selection, Installation, Testing, and Maintenance," document identification number AWWA

M6, American Water Works Association, 1999. The report must reflect the recommendations of this manual and include the rate of service meter change out.

**All service meters are selected, installed and maintained with the procedures and protocols described in the "Manual of Water Supply Practices, Water Meters-Selection, Installation, Testing and Maintenance", document identification number AWWA M6, American Water Works Association, 1999. The Milford Water Utilities Department began a customer meter replacement program in 2003. A total of approximately 3,000 meters have been / will be changed out by the end of 2012. The Milford Water Utilities Department will continue to replace meters at a rate of approximately 10% per year.**

C. *Estimating Unaccounted for water (non-revenue water)/ Water Audit*

1. Most recent water audit, differentiating between apparent and real losses, and estimate of unaccounted for water and the year it was estimated.

**An in-house water audit was completed on the Milford Water Utilities Department in July, 2011. The results are as follows:**
**Total gallons supplied = 337,902,000.**
**Total gallons billed = 335,245,103.**
**Apparent loss = 2,656,897 gallons or 0.8% of system input.**

**This value seems lower than the expected minimum given Milford's water system size and pressure based on the AWWA M6 manual but given the information available at this time, this is the unaccounted for water value the Water Utilities Department is reporting. The Water Utilities Department will be conducting annual meter calibration, water auditing, and leak detection. Unaccounted for water will be revised annually as part of the conservation plan requirements.**

2. Frequency that water audit will be conducted (at least annually).

**Annually**

3. Statement that the water system shall prepare and submit a response plan to the department within 60 days if the percentage of unaccounted for water in the water system exceeds 15 percent of the total water introduced to the water system. The response plan shall identify how the water system intends to reduce the percentage of unaccounted-for water to below 15 percent within two years.

**The water system shall prepare and submit a response plan to the department within 60 days if the percentage of unaccounted for water in the water system exceeds 15 percent of the total water introduced to the water system. The response plan shall identify how the water system intends to**

**reduce the percentage of unaccounted-for water to below 15 percent within two years.**

4. Frequency that water audit will be conducted (at least annually per "Manual of Water Supply Practices, Water Audits and Leak Detection" document identification number AWWA M36, American Water Works Association, 1999). **Annually**

5. Statement that water audit will be calculated in accordance with "Manual of Water Supply Practices, Water Audits and Leak Detection" document identification number AWWA M36, American Water Works Association, 1999.

**Water audits will be calculated in accordance with "Manual of Water Supply Practices, Water Audits and Leak Detection" document identification number AWWA M36, American Water Works Association, 1999.**

2. *D. Leak Detection*

*1. Summary of findings for the most recent leak detection surveys including the following information:*

a) Year(s) conducted.

**2010**

b) Number of leaks found.

**One leak was found on a bleeder on a fire hydrant.**

c) Estimated losses recovered.

**N/A.**

d) Percent of system surveyed.

**Approximately 25%**

*2. Are pipe locations known?*

***Yes***

*3. Breakdown of pipe material, age, and length.*

**This was not completed as part of the survey**

*4. Availability of contact points and adequacy of spacing.*

**Valves and Hydrants are adequately spaced for proper leak detection throughout the distribution system.**

*5. Is pipe material non-metallic? If yes, as leaks are difficult to acoustically detect in non-metallic systems, what additional measures will be taken to detect leaks?*

**There is minimal non-metallic pipe in the system. No additional measures are being taken at this time to detect leaks on non-metallic pipe.**

*6. Will future leak detection surveys be conducted in-house or contracted out?*

**Both in-house and contracted.**

*7. If in-house, what equipment will be used and what training will be required?*

**A Metrotect acoustic microphone The Department staff is already trained in the use of this piece of equipment.**

*8. If in house, describe the leak detection method to be used.*

**Acoustical Detection**

*9. Will zone meters be installed to assist with leak detection identification and location?*

**No**

*10. Statement that a comprehensive leak detection survey will be conducted every two years.*

**A comprehensive leak detection survey will be conducted a minimum of every two years**

*11. Will leak detection be done all at one time or staggered throughout the two years? If staggered, what is the timeline and what percentage of the system will be surveyed during each initiative?*

**Leak Detection will be staggered over the two year period. The Water Utilities Department plans on 50 percent surveying 50 percent on the system during each initiative.**

*12. Statement that leak detection will be conducted in accordance with "Manual of Water Supply Practices, Water Audits and Leak Detection" document identification number AWWA M36, American Water Works Association, 1999.*

**Leak detection will be conducted in accordance with "Manual of Water Supply Practices, Water Audits and Leak Detection" document identification number AWWA M36, American Water Works Association, 1999.**

*13. Statement that leaks will be repaired within 60 days of discovery unless a waiver is obtained in accordance with Env-Wq 2101.09.*

**Leaks will be repaired within 60 days of discovery unless a waiver is obtained in accordance with Env-Wq 2101.09.**

*E. Pressure Management*

*1. Existing minimum distribution pressure.*

**25 psi**

*2. Existing maximum distribution pressure.*

**114 psi**

*3. How is or will pressure be monitored and what will be done to reduce pressures in zones found to be in excess of 80 psi?*

**Milford has homeowner's install pressure reducing valves.**

*4. What will be the timeframe for reduction (at least within 1 year of source water approval)?*

**The pressure reduction to customers is currently in place.**

*5. If pressure reduction is not technically feasible, what additional steps will the water system take to monitor and repair leakage within these zones?*

**The Water Utilities Department will conduct leak surveys in this area of the system on a biannual basis.**

*F. Intentional Water Loss*

*1. Are there "bleeders" used within the system at dead ends to improve water quality or prevent freeze-up? If yes, what looping opportunities exist?*

***No***

*2. Are storage tanks intentionally allowed to overflow because of system hydraulics or water quality concerns? If yes, what opportunities exist for the installation of altitude valves or tank mixing systems?*

**No**

III. CONSUMPTION SIDE MANAGEMENT

A. CONSERVATION RATE STRUCTURE AND BILLING

*1. Description of proposed rate structure and timeline for implementation (no later than 5 years from source water approval). If unknown, provide a statement that the water system will adopt a rate structure that complies with 2101.05 (o) and that DES will be notified of the new structure no later than the first billing cycle after source water approval.*

**The Milford Water Utilities Department bills all its customers the same rate regardless of quantity used, namely, $ 1.97 for each 100 cubic feet of water (748 gallons). There are no plans to change this rate structure.**

2. *If irrigation meters are installed, will irrigation water be billed at a different rate?*

**No**

3. *Will a seasonal rate structure be utilized in addition to the general rate structure?*

**No**

4. *Proposed billing frequency (minimum is quarterly).*

**Quarterly**

5. *Informative billing practices to be used (ex. water use in gallons / usage history).*

**The Water Utilities Department provides a courtesy customer notification based on prior billing history if water usage increases significantly in a given billing cycle.**

B. *Educational Outreach Initiative*

1. *Informational materials that will be used.*

**The Milford Water Utilities Department has an on-going water conservation outreach program that includes the distribution of a poster that lists the top ten ways to minimize indoor and outdoor water use. These posters were posted in several Milford department offices, on the Town of Milford website, and on the local public access cable channel.**

2. *Rate of dissemination.*

**Materials are available online and at the Water Utilities Department Office.**

3. *Does the water system intend on becoming a WaterSense partner? http://www.epa.gov/watersense/*

**Not at this time**

4. *Will a rebate program be offered to replace older fixtures with WaterSense certified fixtures?*

**No**

5. *Will customer audits be offered?*

**No**

6. *Other outreach plans?*

**None**

## IV. ZONING ORDINANCE / BYLAWS

*A. Are connections to the water system subject to any of the following water efficiency ordinances or bylaws?*

*1. Indoor*

a) Water efficient fixtures beyond the existing plumbing code.

**No**

*2. Landscaping*

a) Minimum topsoil requirements.

**No**

b) Use of native/drought tolerant plants and grasses.

**No**

c) Area and slope restrictions for turf grass.

**No**

*3. Irrigation System*

a) Prohibition or restrictions to irrigation systems.

**Outdoor Water Use Restriction during the "odd even day lawn watering program" during periods of drought.**

b) Require soil moisture sensors.

**No**

c) Require rain sensors.

**No**

*4. Other water efficiency ordinances?*

**None**

## V. WATER USE RESTRICTIONS

*A. What is the water system's plan relative to implementing water restrictions?*

**The Milford Water Utilities Department supplies notification of the water restriction to its customers. A bulletin is distributed to all customers, broadcast on local cable television and on the Department's Website.**

*B. Who is responsible for enforcing restrictions?*

**Milford Water Utilities Department**

VI. REPORTING AND IMPLEMENTATION

**1. "The water system will submit a form supplied by DES once every three years documenting how compliance with the requirements of Env-Wq 2101 is being achieved."**

**2. "Activities outlined in the water conservation plan will be completed by water system personnel under the supervision of a certified water system operator."**

**Public Notification**

Within seven days of submitting the conservation plan to DES, the Milford Water Utilities Department shall provide a copy of the application and report via certified mail to the governing board of the department in which a proposed source is located, all municipalities that will receive water from the water system and the regional planning commission serving the location of the proposed source. All signed copies of the Certified Mail Return Receipt will be forwarded to DES.

The Milford Water Utilities Department will forward the Final conservation plan to the governing boards:

Nashua Regional Planning Committee
9 Executive Park Drive, Suite 201
Merrimack, NH 03054

Fred Kind
Milford Conservation Commission
1 Union Square
Milford, NH 03056-04240

**Additional Attachments**
A summary of the requirements of Env-Wq 2101 is included as an attachment to this plan.

# CONSERVATION PLAN

## Monadnock Mountain Spring Water, Inc. (#20621)

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

Monadnock Mountain Spring Water, Inc. is a water bottling company. It has two overburden water supply wells located near its water bottling plant in Wilton, New Hampshire. One is located off Intervale Road and the other is near Mansur Road. Water pumped from these wells is either bottled on site or shipped by truck to another bottling facility located in Massachusetts.

### Water Source and Uses

Monadnock Mountain Spring Water, Inc. has two registered ground water wells, the Mansur Road (20621-S01) and the Intervale Road (20621-S02) wells. Figure 1 shows the location of these wells with respect to the Souhegan River, while Figure 2 is a picture of the Mansur Road well. These overburden wells are 84 feet and 529 feet from the Souhegan River. The drainage area of the Souhegan River at the location of these wells is approximately 64.6 sq. miles.

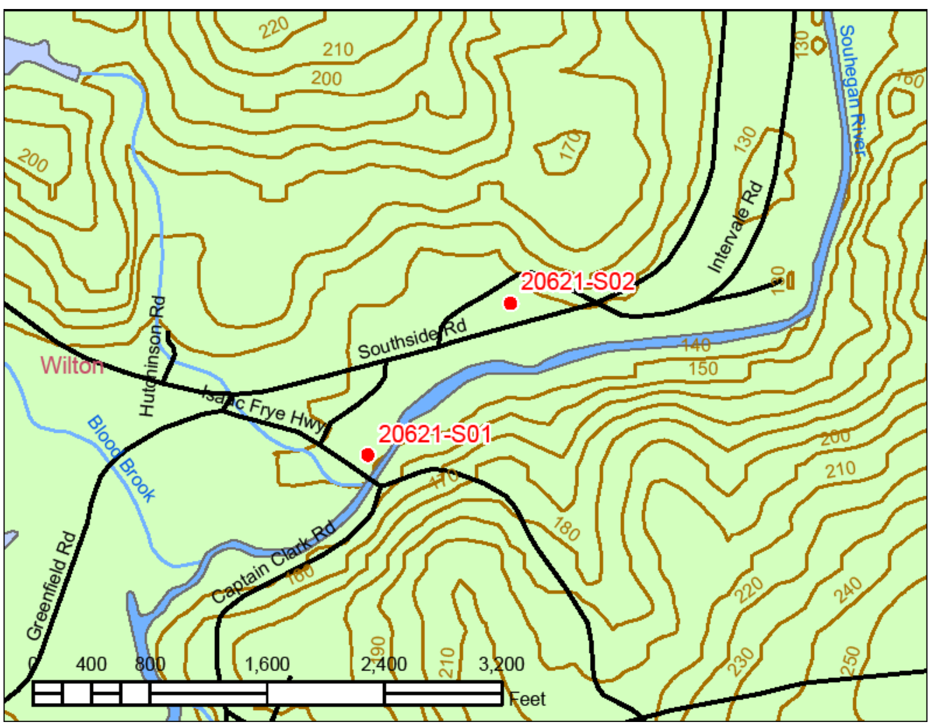


**Figure 1 - Location map of Monadnock Mountain Spring Water, Inc. wells in Wilton, New Hampshire**

**Figure 2 - Monadnock Mountain Spring Water, Inc. Mansur Road well (2004)**

Groundwater is withdrawn primarily during business hours (9 AM – 6 PM). Monadnock Mountain Spring Water, Inc. has 40,000 gallons of storage at the bottling facility, 30,000 gallons for spring water and 10,000 gallons for distilled water. Water is pumped from the wells to storage and from there to the bottling operations. Once a week 8,000 gallons of water are shipped via truck to another bottling operation located in Massachusetts, otherwise the spring water produced on site is used on site.

Although the water source is groundwater, because these wells are located in a stratified drift formation connected to the Souhegan River, the wells could intercept water that would be flowing into or just beneath the Souhegan River. An analysis of induced recharge by these wells was performed as part of the Instream Flow Study (DES 2005). The results of the analysis indicated that the wells do not induce river recharge at normal or maximum pumping rates.

**Water Use Patterns**

Although water use has been reported for each well, over 90 percent of the reported data from 1995 – 2008 is identical for each well. That is because prior to the fall of 2008 the water use was estimated based on bottling production and the total water use was divided by half and reported for each well. In the fall of 2008, Monadnock Mountain Spring Water, Inc. installed recording water use meters on each well and reports this information to DES quarterly.

Water withdrawal is near continuous during normal business hours. The wells are generally pumped at a uniform rate with meter-based water use data showing that the Intervale Well provides two thirds of the total production, while the Mansur Road provides the remainder.

When pumping exceeds demand, excess water fills storage, and when pumping is less than demand, stored water makes up the difference for the bottling operations.

Water use data for Monadnock Mountain Spring Water, Inc. for the years of 1995 through 2008 are presented in a series of graphs (Figures 3 through 8) for each well and for the combined pumping of the two wells. These data are also summarized in Tables 1 through 6. Water use varies from year to year and month to month depending on market demand for bottled water.

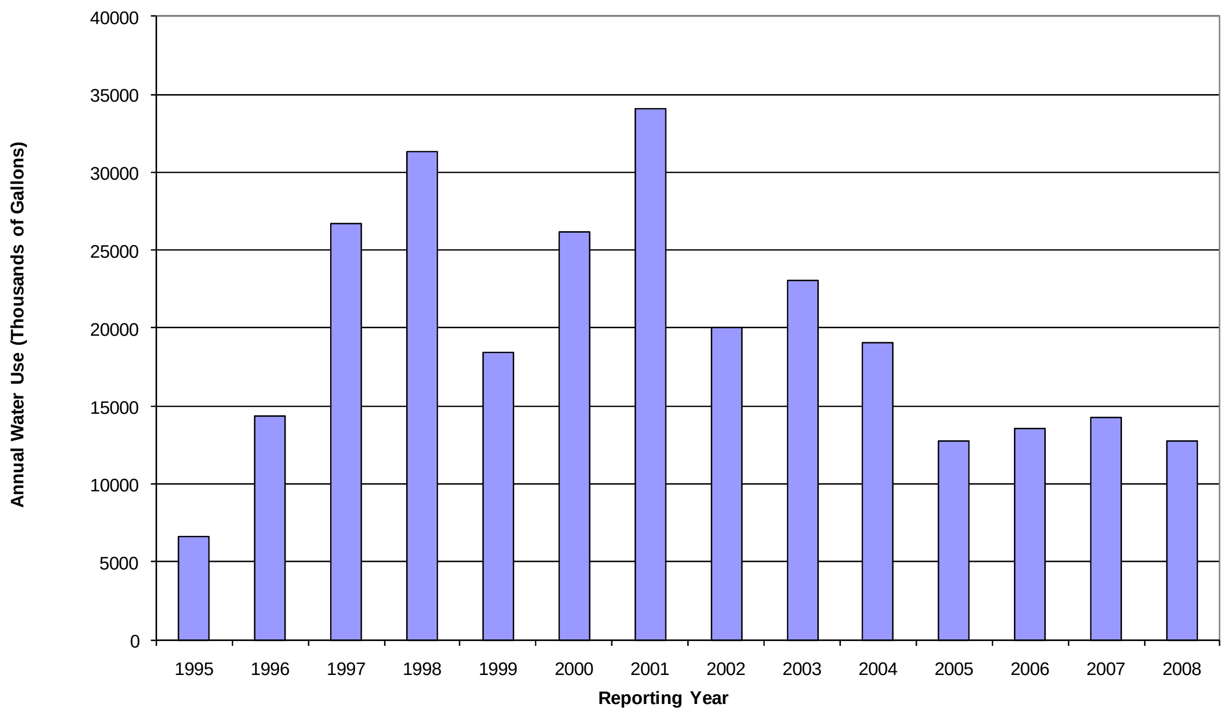


**Figure 3 - Monadnock Mountain Spring Water, Inc. Annual Water Use 1995-2008**

Between 1995 and 2008, annual water use by Monadnock Mountain Spring Water ranged from a high of 34.1 million gallons (2001) to a low of 6.63 million gallons (1995), and has averaged 19.5 million gallons (Figure 3 and Table 1). During this period, annual water use by Monadnock Mountain Spring Water has increased by 6.16 million gallons or 93 percent (Figure 3). This represents an increase of 440,286 gallons a year or 6.6 percent per year over the 14 year period. Annual water use reached a maximum of 34.1 million gallons in 2001, but has since dropped to within the range of 12.7 million gallons (2005) to 14.3 million gallons (2007), a decline of roughly 63 percent.

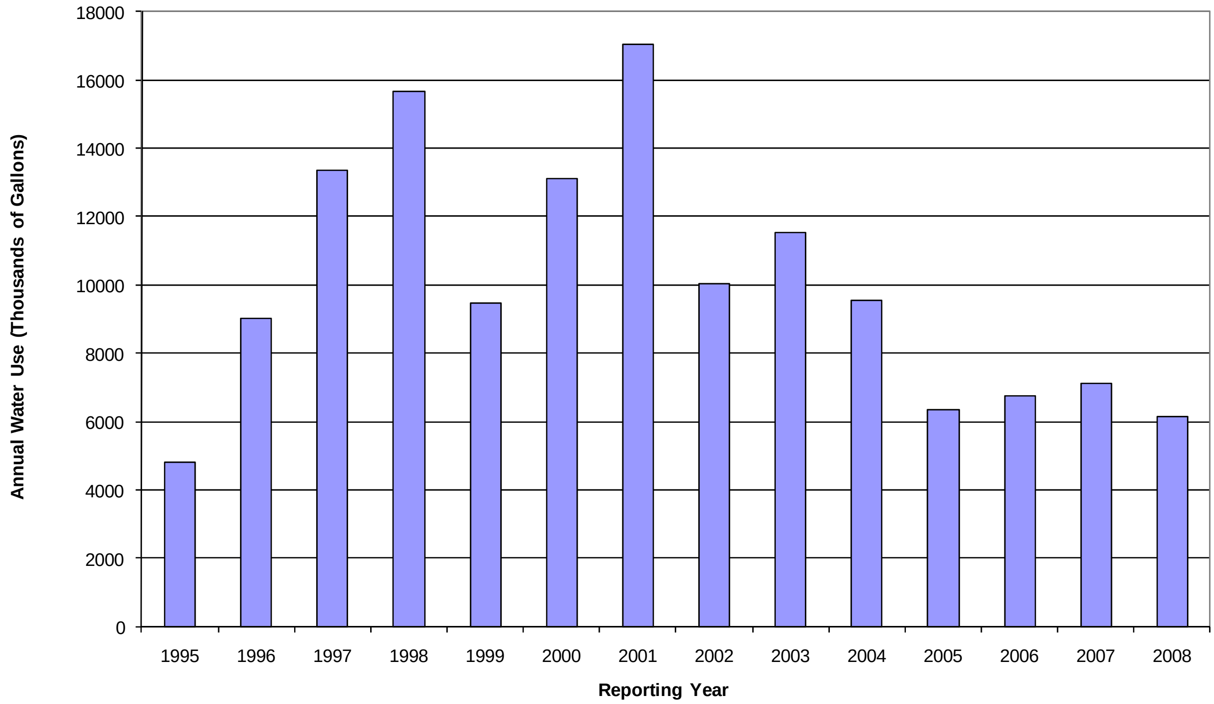


**Figure 4 - Monadnock Mountain Spring Water, Mansur Road Well Annual Water Use 1995-2008**

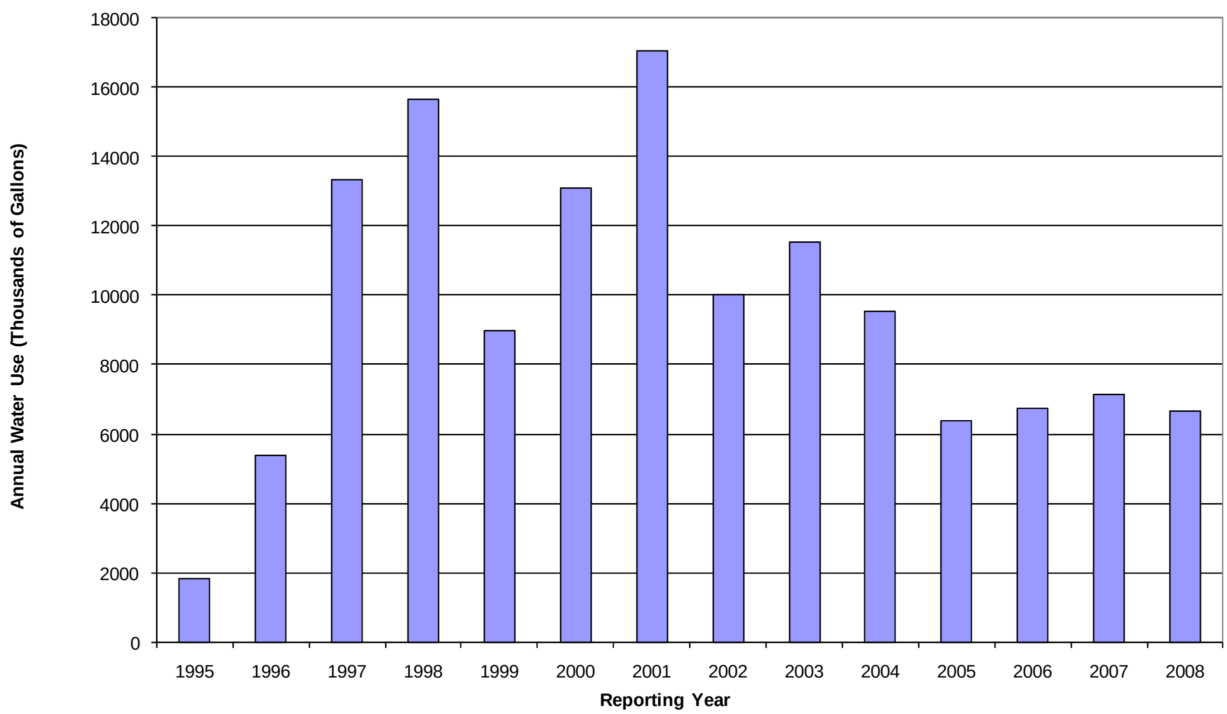


**Figure 5 - Monadnock Mountain Spring Water Intervale Road Well Annual Water Use 1995-2008**

**Table 1 - Monadnock Mountain Spring Water Annual Water Use Statistics (Combined Wells 1995-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 6,629 | 34,107 | 19,515 |
| (cfs) | 0.0281 | 0.1447 | 0.0828 |
| (cfsm at impact point) | 0.0004 | 0.0023 | 0.0013 |
| (cfsm at Merrimack Gage) | 0.0002 | 0.0009 | 0.0005 |

**Table 2 - Annual Water Use Statistics (Mansur Well 1995-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 4,804 | 17,054 | 9,992 |
| (cfs) | 0.0204 | 0.0724 | 0.0442 |
| (cfsm at impact point) | 0.0003 | 0.0011 | 0.0007 |
| (cfsm at Merrimack Gage) | 0.0001 | 0.0004 | 0.0003 |

**Table 3 - Annual Water Use Statistics (Intervale Well 1995-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 1,824 | 17,054 | 9,523 |
| (cfs) | 0.0077 | 0.0724 | 0.0404 |
| (cfsm at impact point) | 0.0001 | 0.0011 | 0.0006 |
| (cfsm at Merrimack Gage) | 0.0001 | 0.0004 | 0.0002 |

Over the period of record, monthly reported water use was highly variable; however, from month to month, the average extraction rate varies in a narrow range (Figures 6, 7 and 8). The highest mean monthly water use was 1.86 million gallons in the summer (July) while the minimum mean monthly water use was 1.47 million gallons (October), reflecting the seasonal change in demand for bottled water (Figures 6, 7, and 8).

Monthly water use data were converted to flow in cubic feet per second by dividing the monthly totals by days and then multiplying this result by a flow unit conversion factor (Tables 4, 5 and 6). Based on these converted values, daily water use by Monadnock Mountain Spring Water has ranged from a minimum of 0.023 cfs (14,736 gallons per day in July, August and September 1995) to a maximum of 1.92 cfs (1.24 million gallons per day in October, November and December 2001), and average use was 0.09 cfs (53,515 gallons per day) for the period of 1995 to 2008 (Table 4).

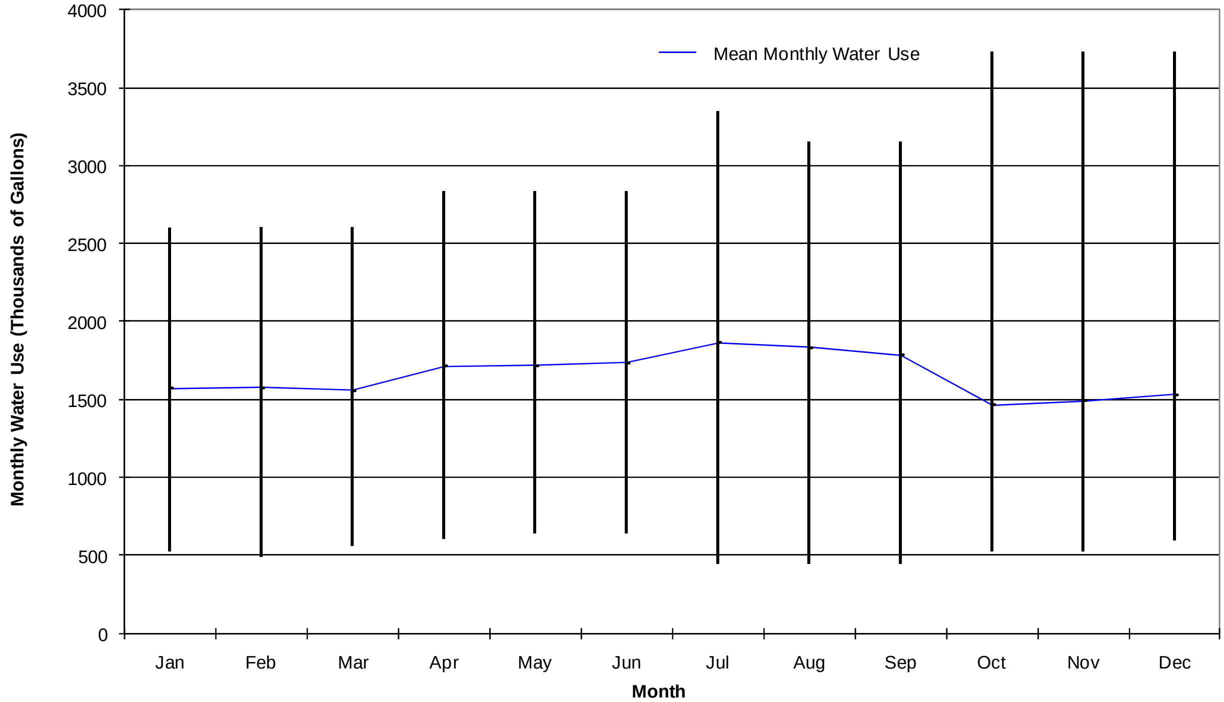


**Figure 6 - Monadnock Mountain Spring Water Monthly Water Use 1995-2008**

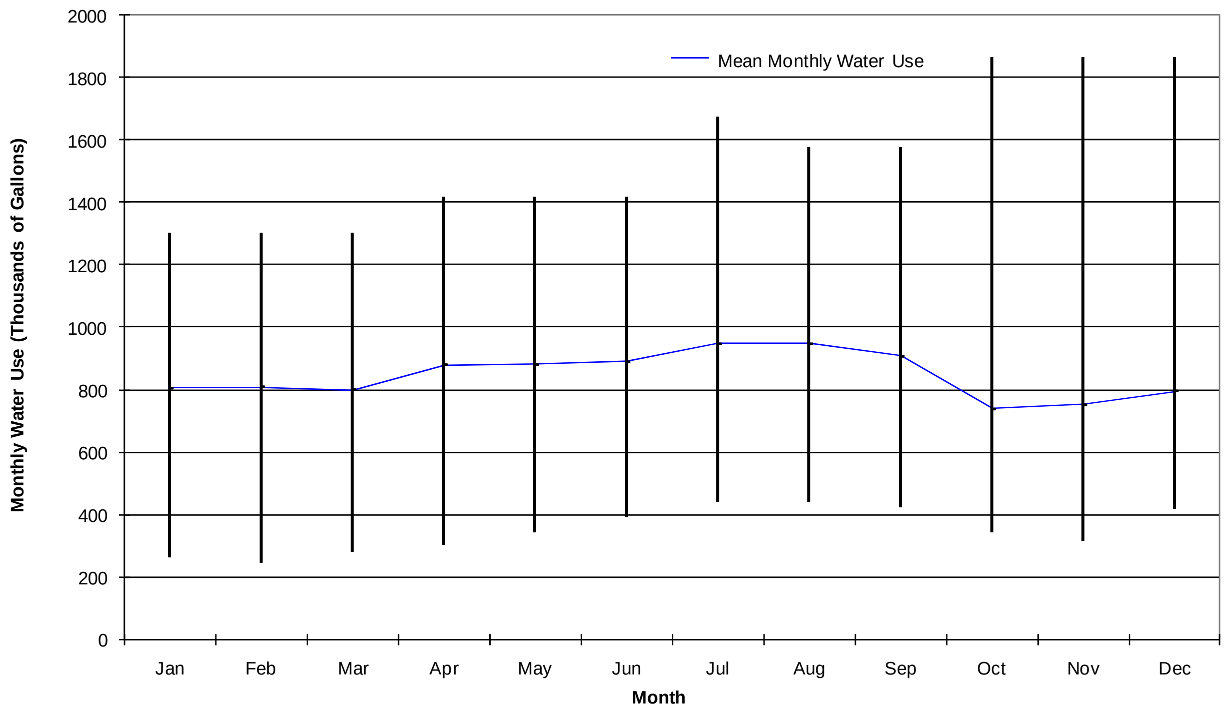


**Figure 7 - Monadnock Mountain Spring Water Mansur Road Well Monthly Water Use 1995 -2008**

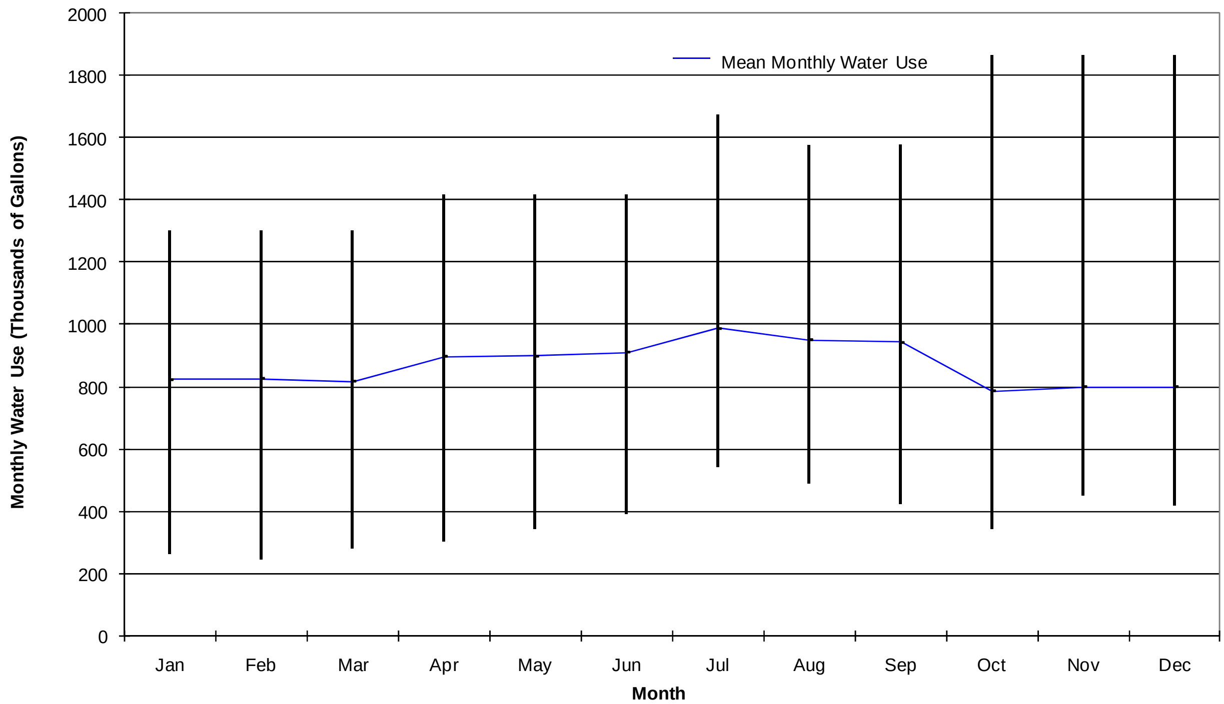


**Figure 8 - Monadnock Mountain Spring Water Intervale Road Well Monthly Water Use 1995-2008**

**Table 4 - Monadnock Mountain Spring Water, Inc. Monthly Water Use Statistics (Combined Wells 1995-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 442 | 3,733 | 1,653 |
| (cfs) | 0.0228 | 0.3250 | 0.0888 |
| (cfsm at impact point) | 0.0004 | 0.0051 | 0.0014 |
| (cfsm at Merrimack Gage) | 0.0001 | 0.0019 | 0.0005 |

**Table 5 - Monthly Water Use Statistics (Mansur Well 1995-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 245 | 1,866 | 846 |
| (cfs) | 0.0135 | 0.1800 | 0.0454 |
| (cfsm at impact point) | 0.0002 | 0.0028 | 0.0007 |
| (cfsm at Merrimack Gage) | 0.0001 | 0.0011 | 0.0003 |

**Table 6 - Monthly Water Use Statistics (Intervale Well 1995-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 245 | 1,866 | 870 |
| (cfs) | 0.0135 | 0.1032 | 0.0443 |
| (cfsm at impact point) | 0.0002 | 0.0016 | 0.0007 |
| (cfsm at Merrimack Gage) | 0.0001 | 0.0006 | 0.0003 |

**Env-Wq 2101 Requirements for Water Conservation Plan**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Water Conservation Rules require different activities depending on the type of water use. Water conservation requirements for commercial water users include: documenting the location and amount of water used for commercial production; installing water meters for each water source; maintaining meters in accordance with "Manual of Water Supply Practices, Water Meters – Selection, Installation, Testing, and Maintenance" (AWWA 1999); and, documenting the water conservation best management practices or best available technologies that may be applicable at the facility.

**Existing Water Conservation Measures**

Recording water meters were installed for each supply well in the fall of 2008, allowing tracking and reporting of individual well production. Meter readings are compared to recorded bottled water production volumes and reported wastewater discharge amounts to detect any variation in expected reported well production and to detect any water leaks. In addition, water storage is checked each day for leaks.

**Water Conservation Alternatives and Costs**

Monadnock Mountain Spring Water, Inc. has implemented most of the basic water conservation measures expected of a commercial operation as part of their normal operations. The development of a formal program for the testing and calibration of the water use recording meters is recommended along with having a formal water audit performed to identify opportunities for implementing additional water conservation measures.

**Conservation Implementation Schedule**

By June 1, 2014, Monadnock Mountain Spring Water, Inc. will finalize a Water Conservation Plan in accordance with Env-Wq 2101 in order to meet the Instream Flow Rule (Env-Wq 1900) requirements for a conservation plan. The Water Conservation Plan will document existing water conservation activities, source water meters maintenance in accordance with the provisions of the Water Conservation Rules, and implementation of water conservation best management practices and best available technologies, where economically feasible.

**Water User Contact Information**

**Water User**: Monadnock Mountain Spring Water, Inc.
**Address**: P.O. Box 518, 8 Mansur Road, Wilton, NH 03086
**Contac**t: Gary Boot
**Phone**: 654-2728
**Email**: monadnock3@tellink.net

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

American Water Works Association (AWWA) 1999. Water Meters – Selection, Installation, Testing and Maintenance. Manual of Water Supply Practices M6. Fourth Edition.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Department of Environmental Services (DES) 2010. Performing a Business or Industry Water Use and Conservation Audit. Environmental Fact Sheet WD-DWGB-26-16.

Personal communication with Gary Boot, Monadnock Mountain Spring Water, Inc.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc.

Water use reports on file with the Department of Environmental Services (DES).

## CONSERVATION PLAN

## OK Tool Source Area (#20832)

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the New Hampshire Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

The OK Tool Source Area (OK Tool site) in Milford, New Hampshire, also referred to as operable unit OU1, is one of two remedial efforts associated with the Savage Municipal Water Supply Superfund site (Site ID #0101145). The remedial actions at the OK Tool site are in response to the contamination of groundwater by volatile organic compounds (VOCs) released from the former industrial operations at the site. There is an active groundwater pumping and treatment system at the site, and treated groundwater is re-infiltrated to the aquifer via underground injection. The remediation activities at the OK Tool site are the responsibility of DES and the United States Environmental Protection Agency (EPA), and are defined under an existing remediation plan.

### Water Source and Uses

The OK Tool site is the source area of a groundwater contamination plume in the Souhegan River aquifer. The source is now contained by a vertical, circular, subsurface, low permeability

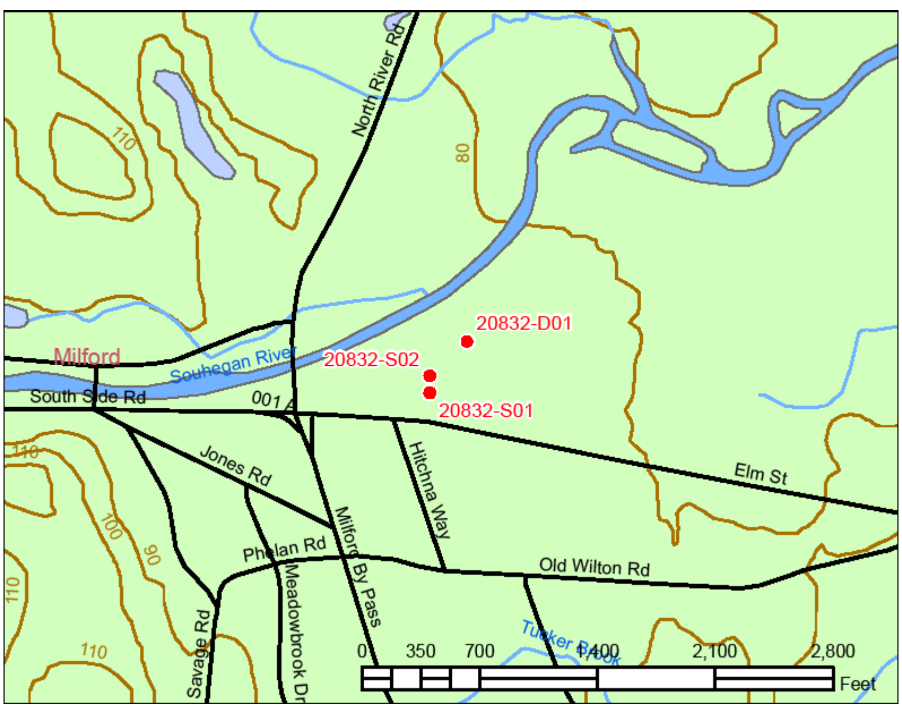


**Figure 1 - Location map of OK Tool Source Area at the Savage Municipal Water Supply Superfund Site in Milford, New Hampshire**

slurry wall. Groundwater is extracted from two six inch wells (20832-S01 and 20832-S02) within the wall. The water is then treated for VOCs via air stripping and returned to the subsurface through a recharge trench (20832-D01) outside the slurry wall. Figure 1 depicts the location of the wells with respect to the Souhegan River. The drainage area of the Souhegan River at the location of these wells is approximately 103 sq. mi.

## Water Use Patterns

Water use is near continuous during normal treatment operations and the wells are generally pumped at a uniform rate of 17 to 20 gallons per minute (gpm). Groundwater pumping is metered, recorded monthly, and reported to DES. Groundwater use data used for this report covered only part of 2008.

According to the water use registration forms on file with DES, the OK Tool site wells are pumped at an average rate of 99,500 gallons per day (gpd) with a maximum rate of 178,560 gpd and an average annual use of 36,317,500 gallons. The water pumped from the extraction wells is returned to the aquifer through a recharge trench down gradient of the extraction wells, thus, there is no net water consumption at this site.

Water use data for the OK Tool site for 2008 are graphically presented in Figures 2, 3, and 4, and summarized in Tables 1, 2, and 3 for the combined well pumping as well as for each well. Monthly water use data were converted to flow in cubic feet per second by dividing the monthly totals by days and then multiplying this result by a flow unit conversion factor.

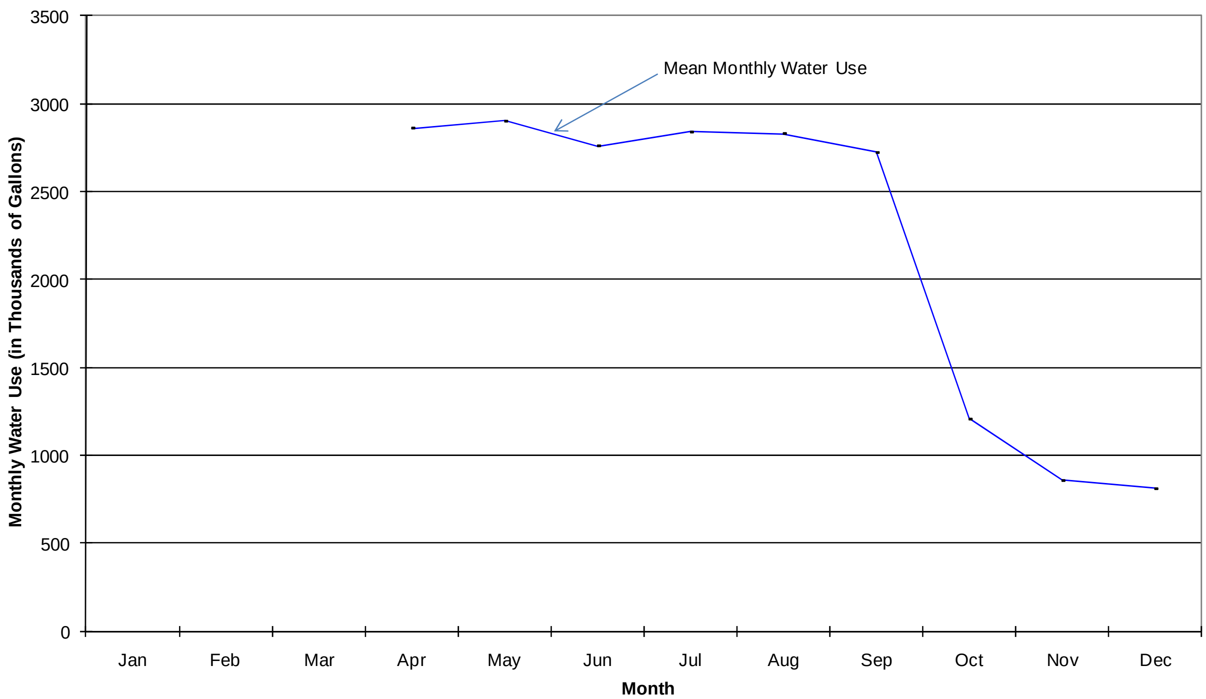


**Figure 2 - OK Tool Site Monthly Water Use for 2008**

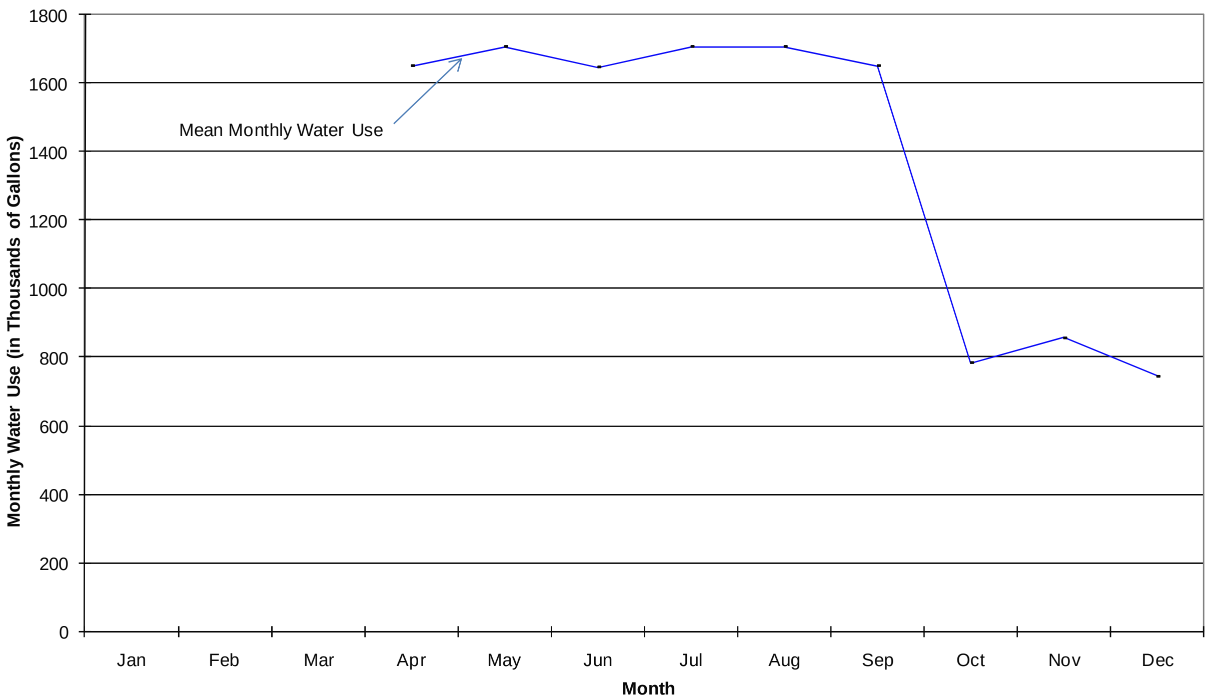


**Figure 3 - OK Tool Site Extraction Well No. 1 Monthly Water Use for 2008**

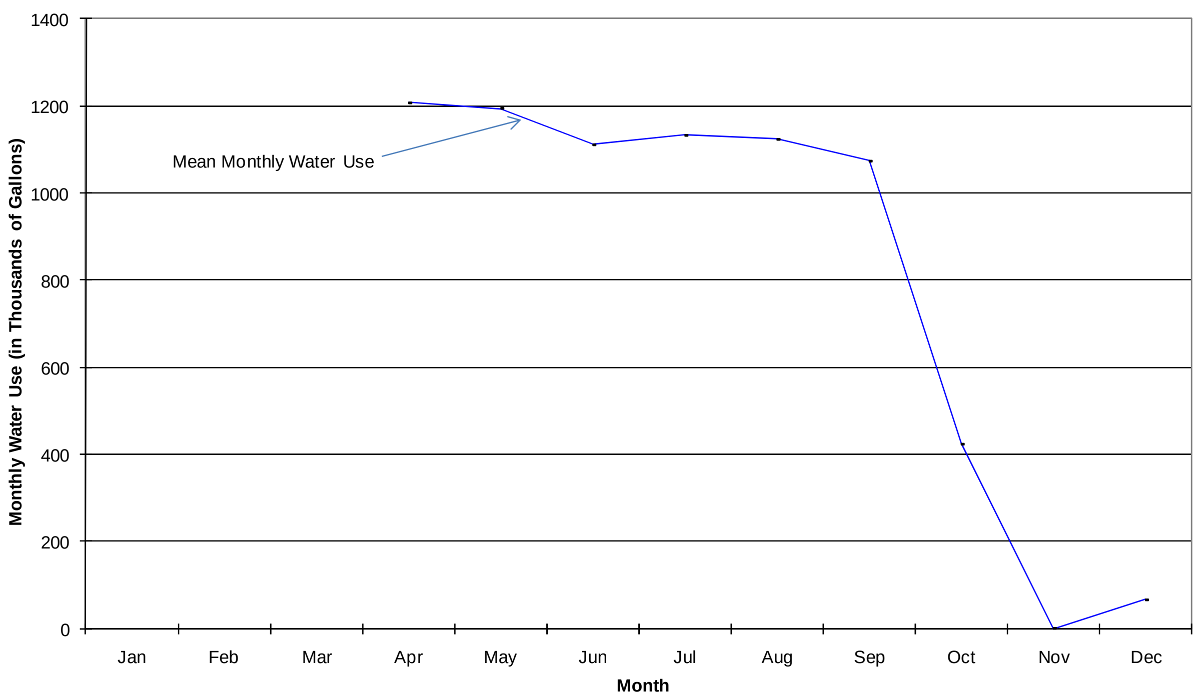


**Figure 4 – OK Tool Extraction Well No. 2 Monthly Water Use for 2008**

**Table 1 - Monthly Water Use Statistics (Combined Wells 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 811 | 2,900 | 2,190 |
| **(cfs)** | 0.0405 | 0.1450 | 0.1110 |
| **(cfsm at impact point)** | 0.0004 | 0.0014 | 0.0011 |
| **(cfsm at Merrimack Gage)** | 0.0002 | 0.0008 | 0.0007 |

**Table 2 - Monthly Water Use Statistics (Extraction Well S01 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 744 | 1,710 | 1,380 |
| **(cfs)** | 0.0372 | 0.0852 | 0.0702 |
| **(cfsm at impact point)** | 0.0004 | 0.0008 | 0.0007 |
| **(cfsm at Merrimack Gage)** | 0.0002 | 0.0005 | 0.0004 |

**Table 3 - Monthly Water Use Statistics (Extraction Well S02 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 1,210 | 812 |
| **(cfs)** | 0 | 0.0623 | 0.0413 |
| **(cfsm at impact point)** | 0 | 0.0006 | 0.0004 |
| **(cfsm at Merrimack Gage)** | 0 | 0.0004 | 0.0002 |

## Env-Wq 2101 Requirements for Water Conservation Plans

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. Water use at the OK Tool site is for the remediation of contaminated groundwater and the operations are specified in a remedial operations plan.

## Existing Water Conservation Measures

Meters are installed on the groundwater extraction wells. Aside from leakage control, there is very little in the way of conservation measures that should be implemented since the withdrawals are returned to the aquifer and the Souhegan River.

## Water Conservation Alternatives and Costs

The remediation activities at OK Tool site are the responsibility of DES and EPA and are specified in a remedial operations plan. Water is removed from within a low permeability cylindrical subsurface slurry wall sealed in till or on bedrock and then returned, after treatment, to a recharge trench outside of the wall. The net effect of the water withdrawals when combined with the returned water has no observable effect on stream flow.

Accurate recording of water use at the site is important to document both the water produced by the extraction wells and the amount discharged to the recharge trench, so that water losses can be identified and eliminated. It is recommended that the water meters for the wells and the discharge to the recharge trench be tested annually, and calibrated if necessary. The cost for this should not exceed $2,000 per year.

**Conservation Implementation Schedule**

By June 1, 2014, DES will finalize a Water Conservation Plan for the OK Tool site in accordance with Env-Wq 2101 in order to meet the Instream Flow Rule (Env-Wq 1900) requirements for a conservation plan. The Plan will document that the water meters at the site are being maintained in accordance with the Water Conservation Rules.

**Water User Contact Information**

**Water User**: State of New Hampshire
**Address**: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
**Contact**: Robin Mongeon
**Phone**: 271-7378
**Email**: Robin.Mongeon@des.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

Water use registration forms on file with the Department of Environmental Services (DES).

Waste Site Cleanup & Reuse in New England – Savage Municipal Water Supply, United States Environmental Protection Agency, website: http://yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/83c7d221bb30028c8525691f0063f6f4!OpenDocument

**CONSERVATION PLAN**

**Otis Falls Dam (#20229)**

## Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

Otis Falls Dam is located on the mainstem of the Souhegan River in Greenville, New Hampshire (Figure 1). The dam is a privately owned hydropower facility licensed by the Federal Energy Regulatory Commission (FERC Project No. 7921) and registered with the DES Dam Bureau (#101.01). According to DES Dam Bureau records, the concrete and stone dam is 150 feet long and 27 feet high (Figure 2). The dam impounds Mill Pond, which is eight acres and used for recreation.

## Water Source and Uses

The hydropower operations at Otis Falls Dam are dependent on stream flow in the Souhegan River. Thus, the hydropower operations are registered with the DES as a water user (20229), with water use reported on a quarterly basis. The dam is operated as run-of-river, meaning that

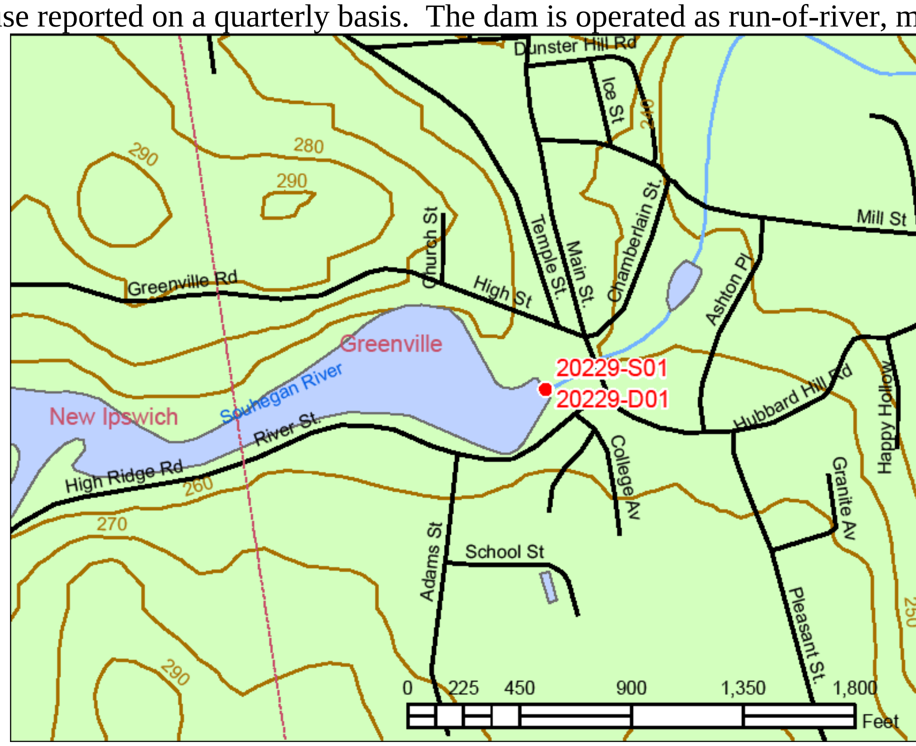


**Figure 1 - Location map of the Otis Falls Dam located in Greenville, New Hampshire**

the operation of the dam does not alter the flow of the river and all of the water diverted through the hydroelectric operations is returned to the river via a penstock 10 feet downstream of the dam.

If sufficient flow is available, the hydroelectric operations at Otis Falls Dam can produce power 24 hours a day, seven days a week, 365 days a year. Under the terms of its license to operate, the facility must allow for a minimum outflow of 10 cubic feet per second (cfs) during the summer (June through September) and 15 cfs during the fall, winter and spring (October through May). When the hydropower facility is not operating, all of the water flows over the top of the dam.

**Figure 2 - Otis Falls Dam looking upstream from the Main Street Bridge in Greenville, New Hampshire (2004)**

### Water Use Patterns

Water use data for the Otis Falls Dam for the period of 1989 through 2008 are shown graphically in Figures 3 and 4 and are summarized in Tables 1 and 2.

Water use is dependent on river flow. On an annual basis, Otis Falls Dam water use has ranged from a low of 2,480 million gallons (2001) to a high of 7,820 million gallons in 2006 (Figure 3 and Table 1). Average annual water use was 5,380 million gallons for the eighteen years that a complete annual record was available. Annual water use has not shown significant upward or downward trends and has mirrored water usage at other Souhegan River dams.

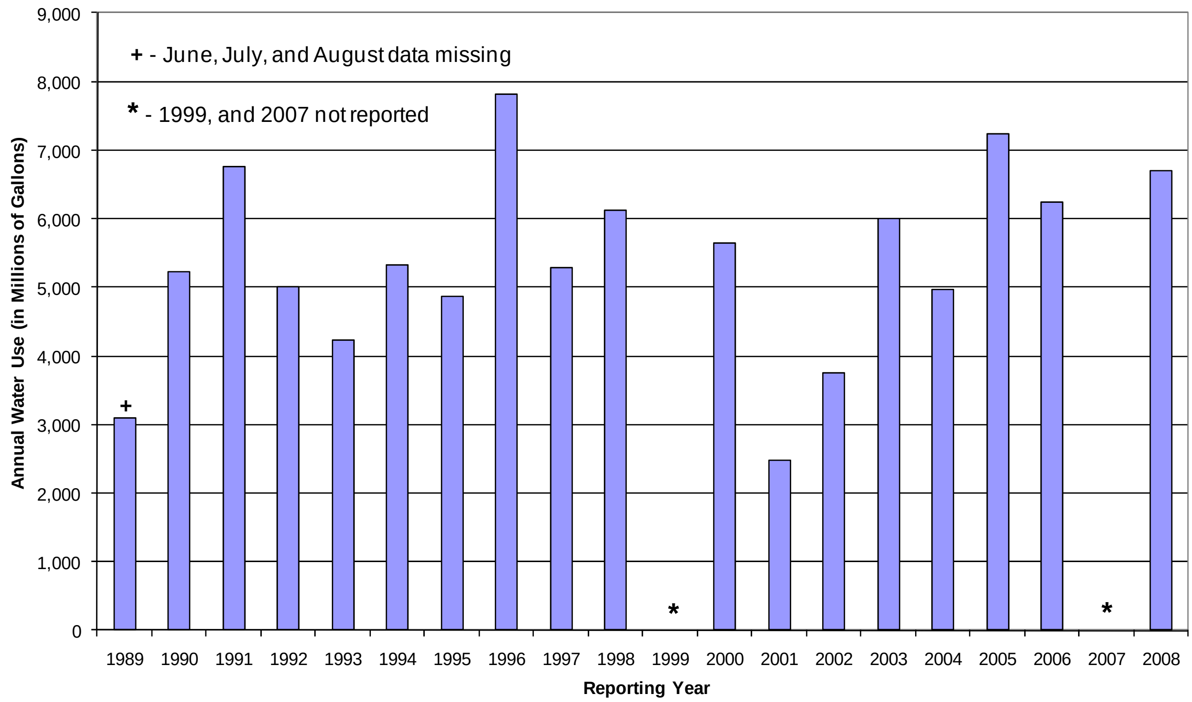


**Figure 3 - Otis Falls Dam Annual Water Use 1989-2008**

**Table 1 - Annual Water Use Statistics (1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 2,480 | 7,820 | 5,380 |
| **(cfs)** | 10.50 | 33.20 | 22.80 |
| **(cfsm at impact point)** | 0.3580 | 1.1300 | 0.7740 |
| **(cfsm at Merrimack Gage)** | 0.0616 | 0.1940 | 0.1330 |

Minimum monthly water use at Otis Falls Dam between 1989 and 2008 was 192 thousand gallons (September 1989) with a maximum of 1,320 million gallons (April 2008), and an average of 454 million gallons (Figure 4 and Table 2). Generally, monthly water use varies between 420 and 520 million gallons per month. Greatest monthly usage is usually during April when river flows are greatest and is typical for a run-of-river dam in New Hampshire.

Monthly water use data in thousands of gallons were converted to cubic feet per second. Daily water use by the Otis Falls Dam has ranged from a minimum of 0.01 cfs (September 1989) to a maximum of 68.30 cfs (April 2008), and average use was 23.10 cfs for the period of 1989 to 2008 (Table 2).

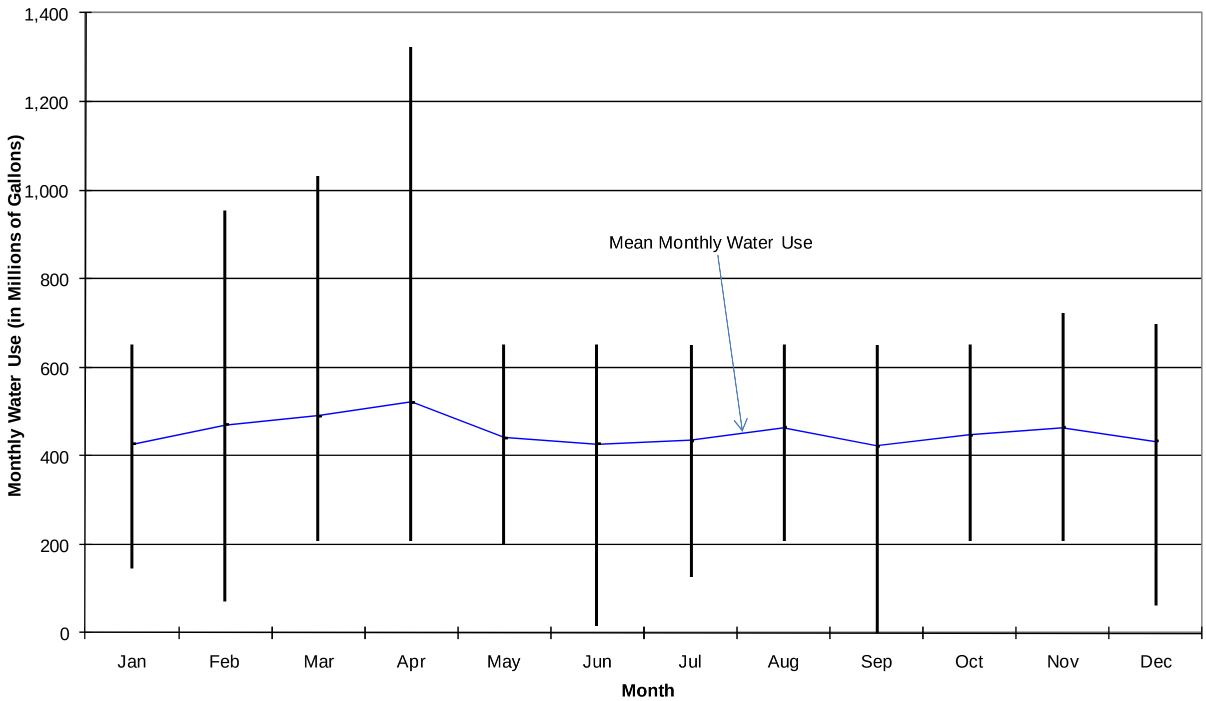


**Figure 4 - Otis Falls Dam Monthly Water Use 1988-2008**

**Table 2 - Monthly Water Use Statistics (1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| (million gal) | 0.192 | 1,320 | 454 |
| (cfs) | 0.01 | 68.30 | 23.10 |
| (cfsm at impact point) | 0.0003 | 2.3200 | 0.7840 |
| (cfsm at Merrimack Gage) | 0.0001 | 0.4000 | 0.1350 |

## Env-Wq 2101 Requirements for Water Conservation Plan

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. Since the Otis Falls Dam is hydroelectric power facility with no consumptive use, a Water Conservation Plan is not required.

## Existing Water Conservation Measures

Since the Otis Falls Dam is managed as a run-of-river operation, no water conservation measures are required at this facility.

## Water Conservation Alternatives and Costs

Because there are no consumptive losses associated with the operation of the Otis Falls Dam facility, no additional water conservation measures are required.

**Conservation Implementation Schedule**

Since no additional water conservation measures are currently required, there is no conservation implementation schedule.

**Water User Contact Information**

**Water User**: Kathleen R. Dolan
**Address**: PO Box 605, Hillsboro, NH 03244
**Contact**: Kathleen R. Dolan
**Phone**: 478-7828
**Email**: Not available

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

New Hampshire Dam Bureau, NHDAMS Data Sheet for Otis Falls Dam.

Personal communication with Robert Greenwood, Alden Hydro, LLC.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed with input from Robert Greenwood of Alden Hydro, LLC.

Water use reports on file with the Department of Environmental Services (DES).

**CONSERVATION PLAN**

**Pennichuck Water/Souhegan Woods (#20659)**

## Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

Pennichuck Water operates the Souhegan Woods Community Water System (CWS) at a development located off of County Road in Amherst, New Hampshire. The water source is an overburden groundwater supply well located along the Souhegan Designated River. This CWS also has an interconnection with the Merrimack Village District as a supplemental water supply.

## Water Source and Uses

Pennichuck Water provides water to the Souhegan Woods CWS from one overburden groundwater supply well (20659-S01). Groundwater is withdrawn from the well on a daily basis to provide drinking water and fire protection to the 115-home, Souhegan Woods subdivision. Since the population served is less than 1,000, Souhegan Woods is a small community water system under the New Hampshire Water Conservation Rules (Env-Wq 2101).

Figure 1 shows the location of the water supply well relative to the Souhegan Designated River. The drainage area of the Souhegan River at the location of this well is approximately 161 sq. miles.

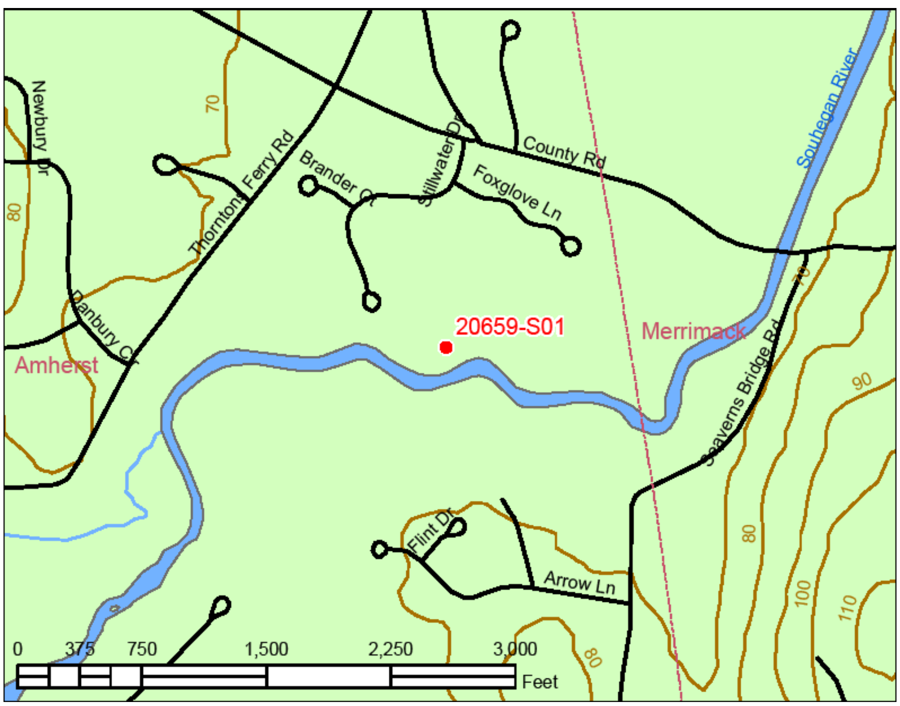


**Figure 1 - Location map of Pennichuck Water's Souhegan Woods water supply well in Amherst, New Hampshire**

Although the water source is groundwater, because the pumped well is located in a stratified drift formation connected to the Souhegan River, the well intercepts water that supports stream flow in the Souhegan River. An analysis of induced recharge by this well was performed as part of the Instream Flow Study (DES 2005). The results of the analysis indicated that it does not induce Souhegan River water recharge at its average or maximum reported extraction rates.

**Water Use Patterns**

Water use is daily and represents common community water supply needs moderated by system storage. Daily water demand follows a diurnal pattern, with the greatest water demand during the day. The well pump runs about five hours per day during the low water use season (winter), and about 17 hours per day during the high water use season (summer), with most of the increased water demand for lawn irrigation. The system includes 40,000 gallons of storage in two atmospheric tanks and 11,000 gallons in a hydro-pneumatic tank. When pumping, the well is pumped at a uniform rate (~ 61 gallons per minute); when pumping exceeds demand, excess water fills storage, and when pumping is less than demand, stored water makes up the difference. Groundwater pumping is metered and monthly totals are recorded, with quarterly reporting to DES.

Water use data for the Souhegan Woods CWS well for the years of 1998 through 2008 are summarized in Figures 2 and 3 and in Tables 1 and 2. Water use records were incomplete for 1998, so 1998 was not included in the annual use summaries. The monthly summaries include all available data from 1998 through 2008.

From 1999 through 2008, the annual water use by Souhegan Woods CWS well ranged from a high of 21.6 million gallons (2002) to a low of 7.94 million gallons (2004), and average use was 15.1 million gallons (Figure 2 and Table 1). During this period, annual water use by Souhegan Woods CWS well has decreased by 5 million gallons or 27.5 percent. This represents a decrease of 500,000 gallons a year or 2.8 percent per year averaged over the 10 year period. Pennichuck Water credits the overall decline in water use to the increased use of water saving fixtures by residents and changing demographics within the community.

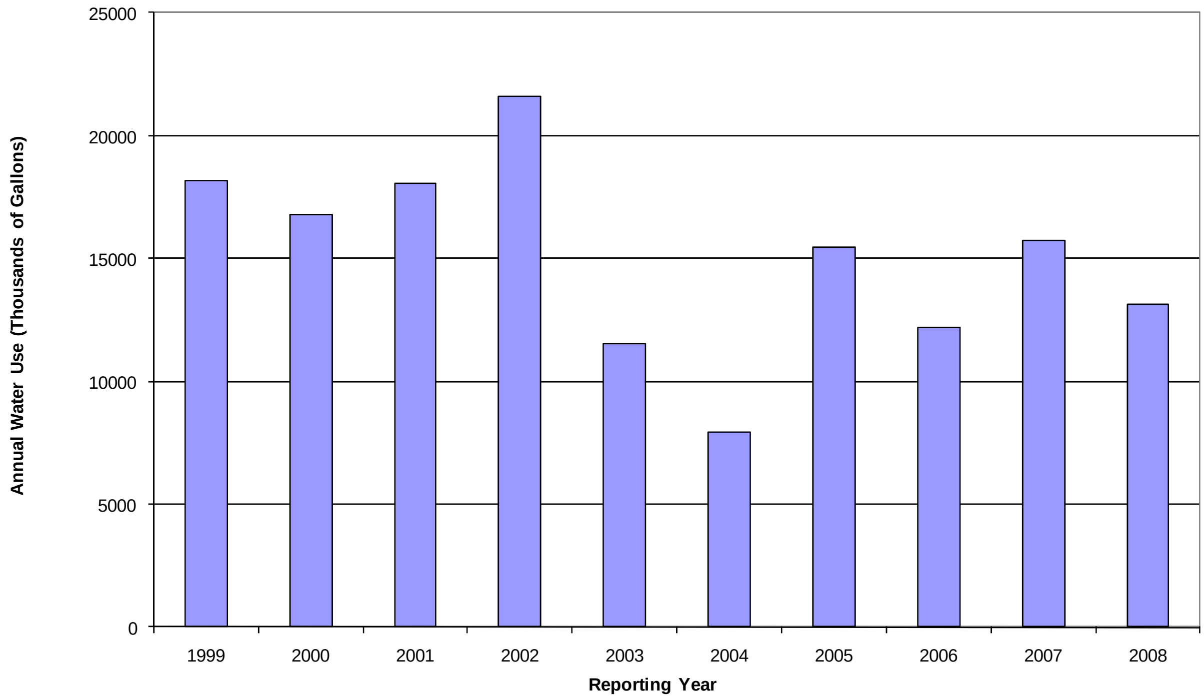


**Figure 2 - Pennichuck Water's Souhegan Woods Well Annual Water Use 1999-2008**

**Table 1 - Pennichuck Water's Souhegan Woods Annual Water Use Statistics (1999-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 7,940 | 21,600 | 15,100 |
| **(cfs)** | 0.0337 | 0.0916 | 0.0639 |
| **(cfsm at impact point)** | 0.0002 | 0.0006 | 0.0004 |
| **(cfsm at Merrimack Gage)** | 0.0002 | 0.0005 | 0.0004 |

Monthly water use records for the system begin in July 1998. Monthly water use varies in response to weather conditions and changes in seasonal demand. Total and average monthly water use was highest during the summer and lowest during the winter. This seasonal pattern reflects increased outdoor water usage (lawn irrigation, gardening, vehicle washing, etc.) during the summer months, which declines during the fall, remains low during the winter, and begins to increase again in the spring. The highest total monthly use was 3.44 million gallons (August 2001), the lowest total monthly use was 145,000 gallons (December 2003), while the average monthly use was 1.24 million gallons (Figure 3 and Table 2).

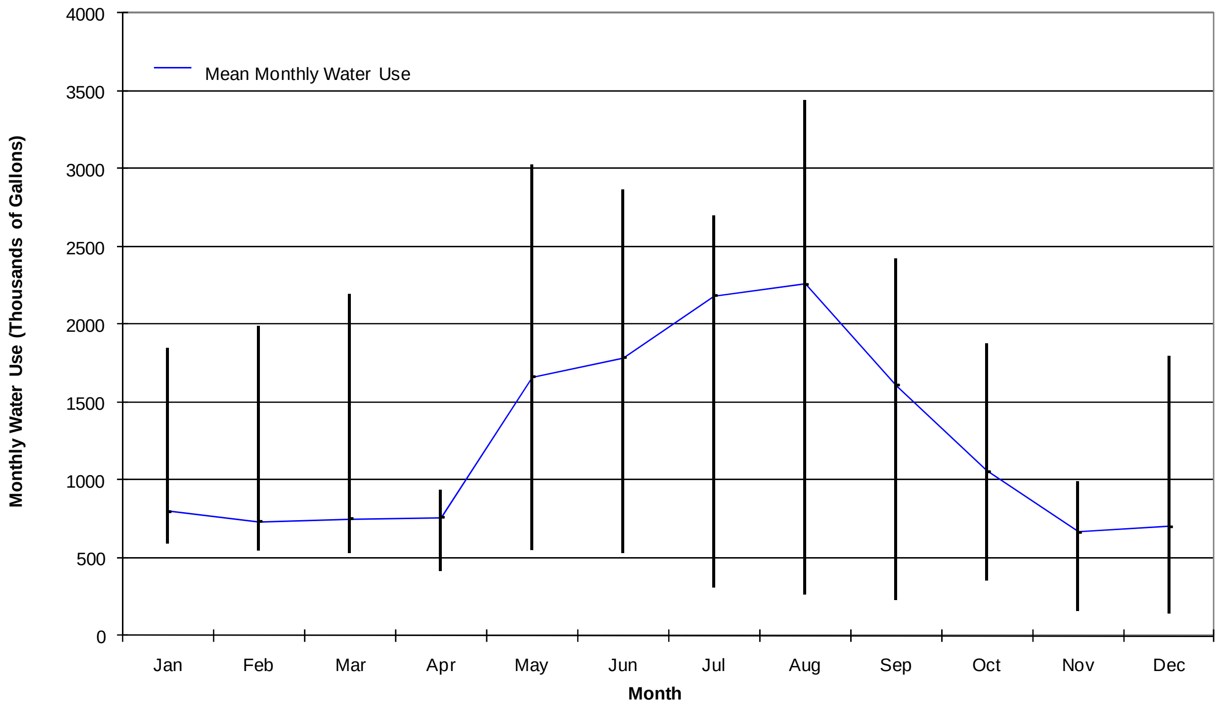


**Figure 3 - Pennichuck Water's Souhegan Woods Well Monthly Water Use 1999-2008**

**Table 2 - Pennichuck Water's Souhegan Woods Monthly Water Use Statistics (1998-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 145 | 3,440 | 1,240 |
| **(cfs)** | 0.0073 | 0.1720 | 0.0632 |
| **(cfsm at impact point)** | 0.0001 | 0.0011 | 0.0004 |
| **(cfsm at Merrimack Gage)** | 0.00005 | 0.0010 | 0.0004 |

Monthly water use data were converted from thousands of gallons per month to cubic feet per second by dividing the monthly total by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gage station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (161 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the average daily water use by the Souhegan Woods CWS well has ranged from a minimum of 0.007 cfs (4,718 gallons per day, December 2003) to a maximum of 0.17 cfs (111,167 gallons per day, August 2001), and average use was 0.06 cfs (40,847 gallons per day) for the period of 1998 to 2008 (Table 2).

## Env-Wq 2101 Requirements for Water Conservation Plan

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Conservation Rules require different activities depending on the type of water use.

Conservation requirements for existing small community water systems such as Souhegan Woods include:

- Installation, maintenance, and use of appropriately selected meters;
- Maintaining low levels of unaccounted-for-water;
- A comprehensive plan for leak detection surveys of the distribution system;
- System pressure reduction, as necessary; and,
- A water conservation educational outreach initiative.

Pennichuck Water will be in compliance with the water conservation plan requirements of the Instream Flow Program by completing a Water Conservation Plan and receiving approval of the Plan by the DES Groundwater and Drinking Water Bureau.

**Existing Water Conservation Measures**

Pennichuck Water's Souhegan Woods CWS has implemented most of the water conservation measures recommended by DES for water utilities and required in the state's Water Conservation Rules (Env-Wq 2101) for small community water systems. The water source is metered and maintained per the AWWA (1999) recommendations. Well production is totaled monthly and reported quarterly to DES. All of the water users in the Souhegan Woods CWS are individually metered, water use is recorded monthly, and water users are billed monthly. Pennichuck Water checks well production against water use totals summed from individual meters monthly to determine if there are discrepancies. If the discrepancy is greater than 15 percent, a leak inspection is performed. Pressure reduction has not been needed and system pressure is below the maximum allowable system pressure of 100 psi. Pennichuck Water provides educational mailings on various water conservation measures to all residents.

Souhegan Woods CWS is provided water by one on-site well along with a connection to the Merrimack Village District (MVD) system. Since it only has one on-site well, Pennichuck Water constantly maintains an odd/even water use restriction for this system. On the off days, water use is limited to a hand held watering container to water vegetable and flower gardens (Pennichuck Water 2009).

Since the Souhegan Woods CWS is connected to the MVD system, Pennichuck Water has not had to institute more restrictive water conservation measures. But, in the event of a water system emergency, Pennichuck Water could implement additional measures including an every fourth day ban on water usage or a complete ban on all outside usage (Pennichuck Water 2009).

Additional water use reductions can be imposed by the MVD system when it provides water to the Souhegan Woods CWS. These may include restrictions or a ban on outdoor water use depending on its system capacity.

## Water Conservation Alternatives and Costs

Pennichuck Water has implemented most of the recommended water conservation measures recommended by DES as Best Management Practices for water utilities (DES 1998 and 2001) or as outlined in the state's Water Conservation Rules (Env-Wq 2101) for small community water systems. Since the source well does not have a direct impact on the Souhegan Designated River and the supplemental source of water (MVD) is located outside of the Water Management Planning Area, no water conservation alternatives are proposed as part of this Conservation Plan and, as a result, there are no costs.

Water conservation activities expected under this Conservation Plan are currently ongoing in the Souhegan Woods CWS service area. If Pennichuck Water or the MVD (when supplying water to the Souhegan Woods CWS) need to implement or maintain more restrictive water conservation measures due to diminished supply from its source(s) or storage, then those actions take precedence over this Conservation Plan. Nothing in this Plan precludes Pennichuck Water or the MVD from further conservation measures on its own initiative.

## Conservation Implementation Schedule

By June 1, 2014, Pennichuck Water will finalize a Water Conservation Plan for the Souhegan Woods CWS as required by Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers. The Plan will document compliance with the requirements for Existing Small Community Water Systems (Env-Wq 2101.06) and will be administered by the DES Drinking Water and Groundwater Bureau under the authority of the Instream Flow Program.

## Water User Contact Information

**Water User**: Pennichuck Water Works
**Address**: P.O. Box 1947, 25 Manchester Street, Merrimack, NH 03054-1947
**Contact**: Donald Ware
**Phone**: 913-2330
**Email**: donald.ware@pennichuck.com

### Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
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| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

American Water Works Association (AWWA) 1999. Manual of Water Supply Practices, Water Meters – Selection, Installation, Testing and Maintenance. Manual M6.

Department of Environmental Services (DES) 1998. Developing a Utility Water Conservation Program. Environmental Fact Sheet WD-WSEB-6-1.

Department of Environmental Services (DES) 2001. Implementing a Water Efficiency and Conservation Program for Public Water Utilities. Environmental Fact Sheet WD-WSEB-26-9.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Pennichuck Water 2009. Emergency Action Plan: Souhegan Woods.

Personal communications with Donald Ware, Pennichuck Water.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Donald Ware.

Water use reports on file with the Department of Environmental Services (DES).

# CONSERVATION PLAN

## Peter de Bruyn Kops (#20383)

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

Mr. Peter de Bruyn Kops operates a commercial farm located in Amherst, New Hampshire. The farm produces various crops based on market demand. In the past, the farm has relied on irrigation water withdrawn from the Souhegan Designated River for crop watering and occasionally for frost prevention.

### Water Source and Uses

Mr. Peter de Bruyn Kops registered with the DES in 1993 and reported his water use from 1994 through 2003. During this period, however, water use only occurred in 1997, 1998 and 1999. The facility has been officially inactive as a water user since 2003 and has not reported water use since that time. At the request of Mr. de Bruyn Kops, his farm operations are being included in the development of the Souhegan River Water Management Plan.

Since the early 2000s, the crops produced at the farm (hay, clover, canola, vegetables and flowers) have not required reportable levels of water use for irrigation. Records for surface water use by Mr. de Bruyn Kops are available from DES for the period of 1994 through 2003.

Water is withdrawn from the Souhegan River via a removable pipe that is connected to an eight inch irrigation pipe. The intake is located in the Town of Amherst, approximately 10 miles upstream from its confluence with the Merrimack River (Figure 1). The drainage area of the Souhegan River is approximately 156 square miles at the point of withdrawal.

Water was withdrawn on an “as needed” basis and used to irrigate a mixture of crops. In the early 2000s irrigation withdrawals from the river ceased, since the majority of the farm is used for the production of hay (alfalfa, alfalfa-grass, clover-grass and grass), sweet clover and honeybee forage. Prior to 2000, six to ten acres were used and irrigated for the production of pumpkins and winter squash. Less than an acre is used for the production of general vegetables utilizing drip irrigation sourced from a domestic well and an oxbow pond.

### Water Use Patterns

Water use is on an as-needed basis, potentially seven days per week, and is weather dependent. If less than one inch of water is provided by rainfall during a week, the remaining fraction of water is provided by daytime irrigation. Water use is not metered, but is estimated from the sprinkler flow rates

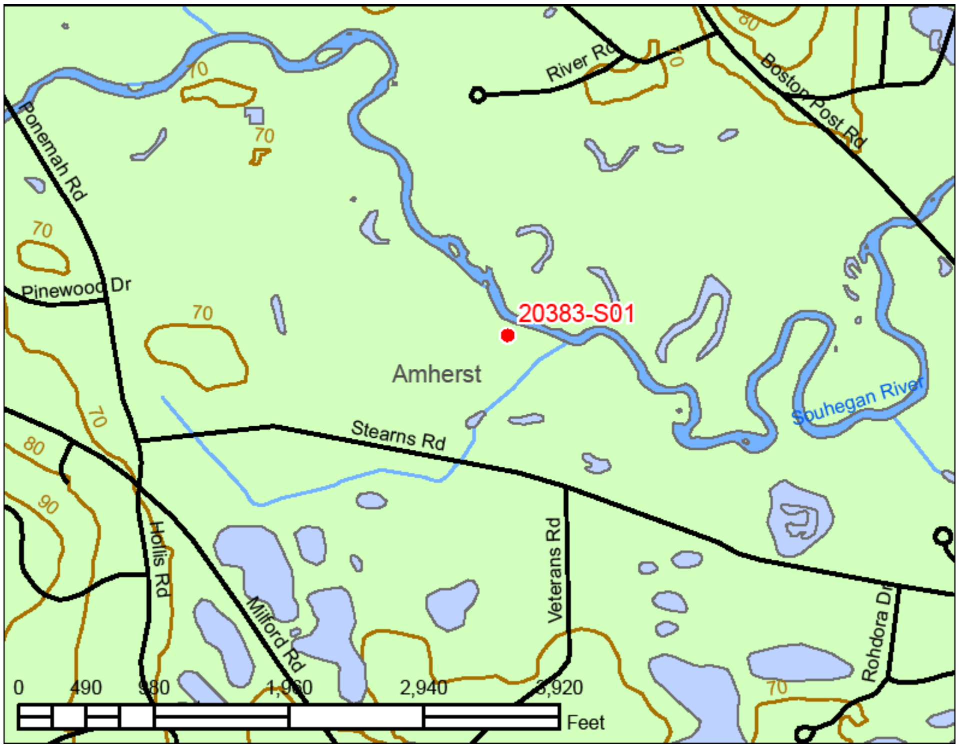


**Figure 1 - Location map of Mr. Peter de Bruyn Kops withdrawal from the Souhegan Designated River in Amherst, New Hampshire**

Water use data for Peter de Bruyn Kops for the years of 1994 through 2003 are summarized in Figures 2 and 3 as well as in Tables 1 and 2. Between 2003 and 2008, Mr. de Bruyn Kops did not use river water for crop irrigation and therefore stopped reporting withdrawals to DES. Although his registration as a water user is now considered inactive, he may withdraw water from the Souhegan Designated River for irrigation again in the future.

Water use varied from year to year and month to month, depending primarily on rainfall, weather conditions and the growing season. Annually, usage has ranged from a low of 0 gallons (multiple years) to a high of 520 thousand gallons (1997) and has averaged 100 thousand gallons for the reporting period (Figure 2 and Table 1). During this 10 year period (1994 through 2003), water was only withdrawn from the Souhegan Designated River in 1997, 1998 and 1999.

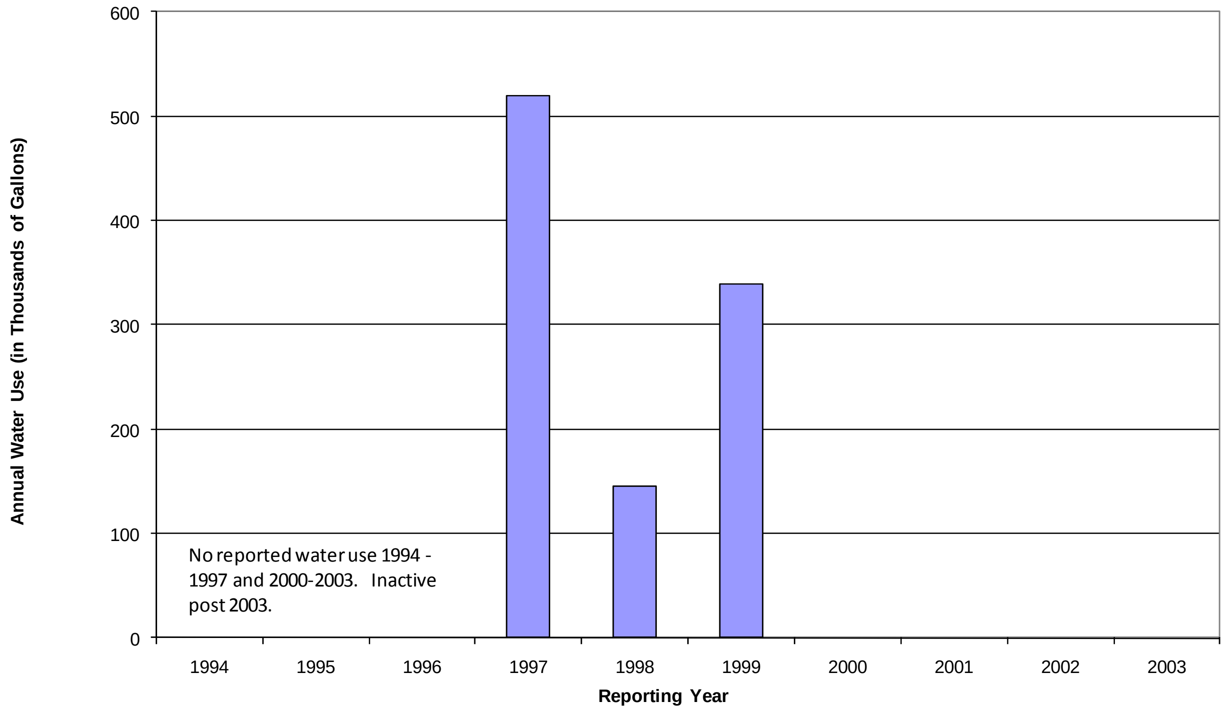


**Figure 2 - Peter de Bruyn Kops Annual Water Use, 1994-2003**

**Table 1 - Peter de Bruyn Kops Annual Water Use Statistics (1994-2003)**

| | Low | High | Average |
|---|---|---|---|
| **(1,000 gal)** | 0 | 520 | 100 |
| **(cfs)** | 0 | 0.0022 | 0.0004 |
| **(cfsm at impact point)** | 0 | 0.00001 | 0.000003 |
| **(cfsm at Merrimack Gage)** | 0 | 0.00001 | 0.000003 |

Monthly water use changes seasonally with crop irrigation demand and rainfall. There has been no reported water use during the months of October through May due to plant dormancy conditions (Figure 3). Mean monthly water use increases from June through August and then decreases from August to October, which parallels the expected water demand during a growing season. The maximum monthly use for the reporting period was 178 thousand gallons during August 1997. Average monthly water use for the growing season months of April through October was 14,000 gallons (Table 2).

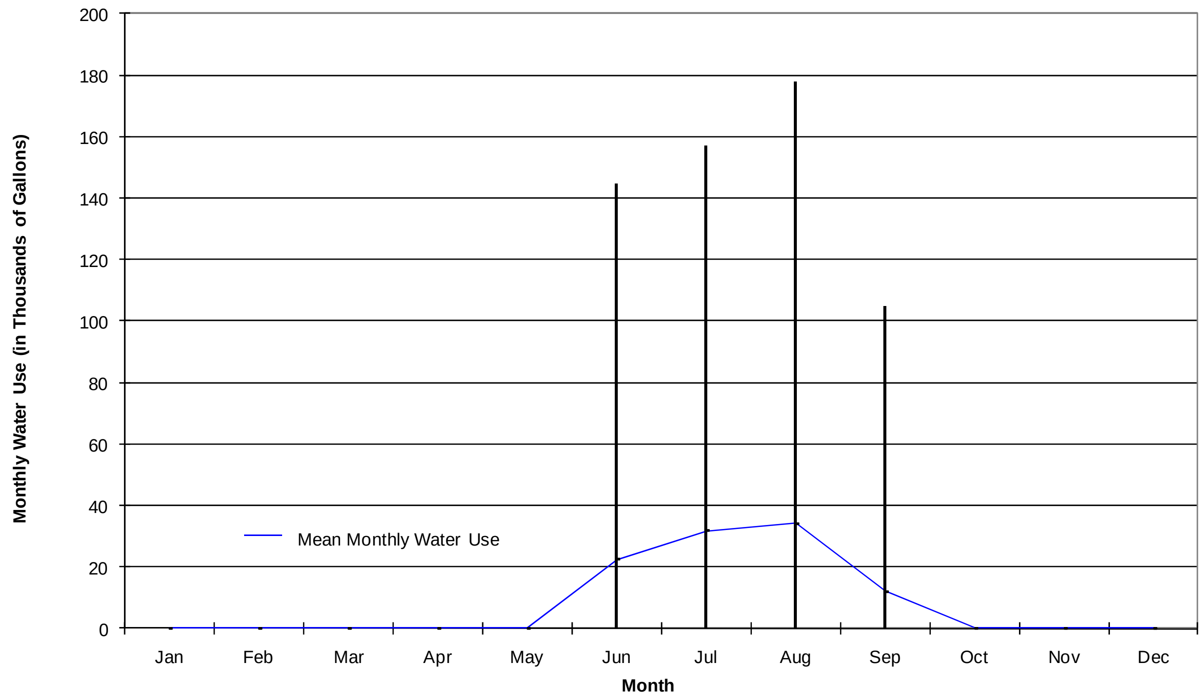


**Figure 3 – Peter de Bruyn Kops Monthly Water Use, 1994-2003.**

**Table 2 - Monthly Water Use Statistics (1994-2003)**

| | Low | High | Average | Apr - Oct avg |
|---|---|---|---|---|
| (1,000 gal) | 0 | 178 | 8 | 14 |
| (cfs) | 0 | 0.009 | 0.0004 | 0.007 |
| (cfsm at impact point) | 0 | 0.00006 | 0.0000003 | 0.00004 |
| (cfsm at Merrimack Gage) | 0 | 0.00005 | 0.0000003 | 0.00004 |

Monthly water use data were converted to average monthly flow in cubic feet per second (cfs). Based on these values, monthly water use by Peter de Bruyn Kops has ranged from a minimum of 0 cfs (October through May in all years, all of 1994-1996, and all of 2000 through 2003) to a maximum of 0.009 cfs (August 1997), with an average of 0.007 cfs for the April – October period and 0.0005 cfs annually from 1994 through 2003.

**Env-Wq 2101 Requirements for Water Conservation Plans**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Water Conservation Rules require different activities depending on the type of water use. All water users who irrigate crops associated with agriculture shall implement irrigation processes in accordance with the 1998 edition of the Irrigation Best Management Practices for Agriculture in New Hampshire, published by the Department of Agriculture, Markets and Food.

Best Management Practices for irrigation are based on the implementation of the following management techniques in concert with knowledge of site specific variables:

- Scheduling irrigations with appropriate amounts and frequency;
- Measuring current soil water status, rainfall and irrigation water applied; and,
- Balancing rainfall and irrigation applications with crop water use.

**Existing Water Conservation Measures**

Mr. de Bruyn Kops stopped withdrawing water from the Souhegan Designated River in 2000, reported no water use from 2000 to 2003 and since 2003 has been an inactive water user. Presently, his irrigation use is limited to less than one acre of general vegetables and the sources for the irrigation water include a domestic well and an oxbow pond.

Mr. de Bruyn Kops presently employs several of the recommended water conservation practices for agricultural irrigation. He uses an adaptive irrigation schedule based on crop watering needs and rainfall. When vegetable crops are grown, irrigation is used to supplement rainfall to total one inch of applied water per week. When irrigation is used, he employs a routine inspection and maintenance program and follows the manufacturers recommended sprinkler configuration patterns.

He also uses plastic landscape fabric to eliminate weeds and to reduce the need for irrigation. He is aware of the development and use of polymers that can be mixed with soil to improve water retention. He has not used these due to their expense and his concerns regarding the unintended consequences of using them in a floodplain. In addition, the polymers are tough to remove once incorporated into the soil.

**Water Conservation Alternatives and Costs**

Mr. de Bruyn Kops water conservation efforts include several of the agricultural irrigation efficiency practices recommended by DES and the New Hampshire Department of Agriculture (1998). Use of these water conservation practices are to be continued under this Conservation Plan.

Mr. de Bruyn Kops was a registered water user, but his water use has been below the reporting threshold of 140,000 gallons in any seven-day period for after 1999. No actions are required under this Conservation Plan as long as water use remains below 140,000 gallons per week. If water use exceeds this amount, Mr. de Bruyn Kops is required to measure and report water use in accordance with the rules for Water User Registration and Water Use Reporting for agricultural facilities (described in Env-Wq 2202.27 through Env-Wq 2202.32). Water use will be reported to the DES Drinking Water and Groundwater Bureau.

As part of this plan, Mr. de Bruyn Kops will also notify the Water Use and Conservation Program, and coordinate access for them to use an ultrasonic flow meter during irrigation to assist in verifying that his water use measurements are accurate within 10 percent as required by Env-Wq 2102.10 of the Water Use Registration and Reporting Rules. If the difference between the estimated water use and the measured water use is greater than 10 percent, then Mr. de Bruyn Kops will be required to install flow meters on any sources using more than the reporting threshold in order to accurately record his water use reported to DES.

The cost of a recording meter may range from $500 to $1,000. The meter should be tested annually and calibrated if it does not meet the 10 percent accuracy requirement. Annual meter bench testing may cost between $300 and $400, and calibration, if needed, may cost an additional $100 to $200.

If water use increases to levels greater than the reporting threshold, Mr. de Bruyn Kops will document and use more objective crop demand irrigation criteria based on soil moisture and plant condition to determine when irrigation is needed, as opposed to a general rule of one inch of water per week. The use of soil moisture, crop canopy or a water budget approach is recommended Best Management Practices for irrigation scheduling (New Hampshire Department of Agriculture 1998). In addition, the state recommends replacing existing oscillation sprinkler heads with micro-irrigation devices, where feasible, to reduce water use and improve water efficiency.

**Conservation Implementation Schedule**

Compliance with the water use reporting and recording accuracy requirements for agricultural facilities as described in (currently Env-Wq 2102.26 through Env-Wq 2102.30) will be implemented following the acceptance of this Conservation Plan and if water use exceeds the reporting threshold of use of 140,000 gallons in any seven day period. Mr. de Bruyn Kops will request the assistance of DES in testing his withdrawal flow rates within two months of his first exceeding the reporting threshold of 140,000 gallons in any seven day period. If metering is required as determined by the Water Use and Conservation Program, the meter(s) will be installed within three years of that determination. Development and use of more objective irrigation criteria should be implemented within two years of the first incidence of meeting the reporting threshold.

**Water User Contact Information**

**Water User:** Mr. Peter de Bruyn Kops
**Address:** 427-3 Amherst Street 341, Nashua, 03063
**Contact:** Same as user
**Phone:** 603-673-8392
**Email:** dkb@acugen.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot | 43,560 | cubic feet |
| 1 | acre-foot | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information:**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

New Hampshire Department of Agriculture, Markets & Food 1998. Irrigation: Best Management Practices for Agriculture in New Hampshire. pp. 18.

Department of Environmental Services (DES) 2010. Water Efficiency Practices for Agricultural Irrigation. Environmental Fact Sheet WD-DWGB-26-5.

Personal communication with Mr. Peter de Bruyn Kops.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Peter de Bruyn Kops.

Water use reports on file with the Department of Environmental Services (DES).

**CONSERVATION PLAN**

**Pilgrim Foods, Inc. (#20681)**

## Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

Pilgrim Foods, Inc. (Pilgrim Foods), which is owned by the Old Dutch Mustard Co., Inc., is a food production facility located off of Old Wilton Road in Greenville, New Hampshire. Pilgrim Foods prepares several lines of foods products (mustard, vinegar and fruit juices) for sale under the "Old Dutch" name brand. This facility uses water from several sources as part of its operations. These sources include the Town of Greenville water supply system, a well leased from the Town (Souhegan River Well), and two on-site ground water supply wells.

## Water Source and Uses

Pilgrim Foods has four registered water sources: the Town of Greenville water supply system (20681-S01); the Souhegan River Well (20681-S02); and two on-site wells (20681-S03 and 20681-S04). Figure 1 shows the location of the wells with respect to the Souhegan Designated River. The Souhegan River Well is located within 100 feet of the designated river, but is no longer used by Pilgrim Foods. One of the on-site wells (20681-S03 or Dube Well) is located

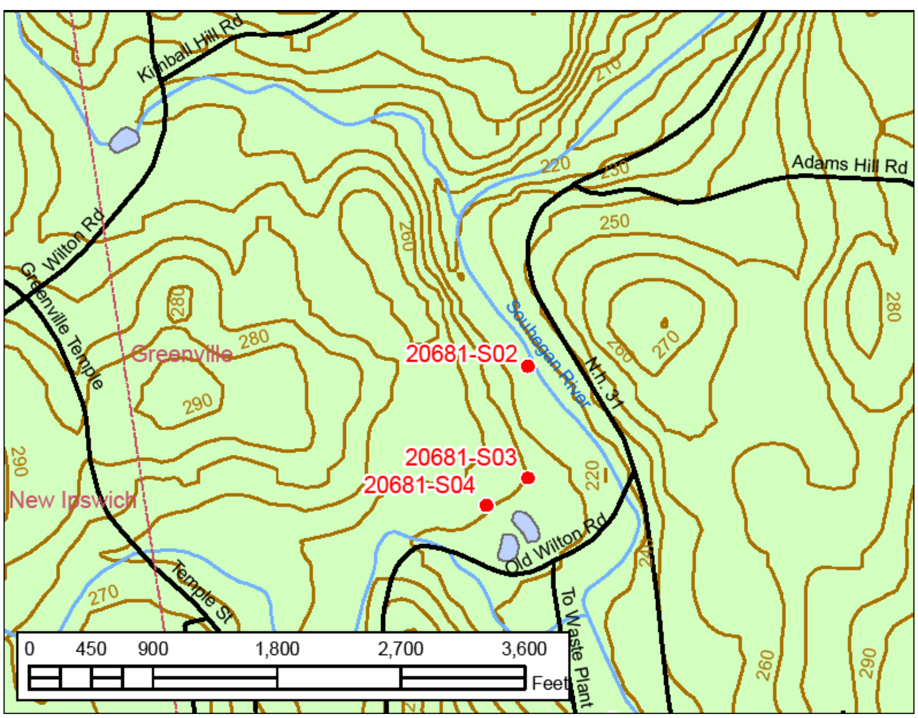


**Figure 1 – Location map of Pilgrim Foods, Inc. wells in Greenville, New Hampshire**

within 400 feet of the designated river, while the other on-site well (20681-S04 or Davis Well) is located within 400 feet of a stream that flows across the southwest portion of the Pilgrim Foods site and is a tributary to the Souhegan Designated River. The drainage area of the Souhegan River at the location of these wells is approximately 31.6 sq. mi.

The Town of Greenville water system has been used by Pilgrim Foods since it began reporting water use in 1999 and remains its principal source of water. The Souhegan River Well was used along with the water purchased from the Town of Greenville water system until the end of 2006, when the well lease expired. The two on-site wells were inactive from 1999 through 2008, but Pilgrim Foods began using these wells in 2009 to reduce the amount of water purchased from the Town of Greenville. The production of these wells ranges from 4 to 8 gallons per minute (gpm) for the Dube Well (20681-S04) to 12 - 15 gpm for the Davis Well (20681-S03). Pilgrim Foods can also store 20,000 gallons of water in on-site storage tanks.

Water use by Pilgrim Foods is daily, Monday through Friday during normal operating hours (7 am to 4 pm). Water use is metered by each source and is checked weekly. Total monthly water use is reported to DES quarterly.

**Water Use Patterns**

Water use data for Pilgrim Foods for 1999 through 2008 are presented in Figures 2 through 7 for total water use and for the individual sources. These data are also summarized in Tables 1 through 6. Water use data were available for the period of 1999 through 2008 for the Greenville water supply source and the Souhegan River Well (now inactive), but no water use was reported for the two on-site wells. The monthly water use records are incomplete for 1999 through 2001, with complete monthly records beginning in 2002.

Between 1999 and 2008, annual water use by Pilgrim Foods ranged from a high of 17.3 million gallons (2006) to a low 2.80 million gallons (2002) and has averaged 12.39 million gallons (Figure 2 and Table 1). During this period, annual water use by Pilgrim Foods has increased by 9.50 million gallons or 140 percent (Figure 2). This represents an increase of 951,200 gallons a year or 14 percent per year over the ten year period. The increase in water use by Pilgrim Foods directly reflects the increased production at the facility over this time.

Annual water use by Pilgrim Foods increased steadily from 1999 to 2007, except for the significant drop experienced in 2002 (Figure 2). The dramatic reduction in water use that year is due to a fire at the facility in December 2001 which significantly impacted their business operations. Since its peak in 2007, annual water use declined slightly in 2008.

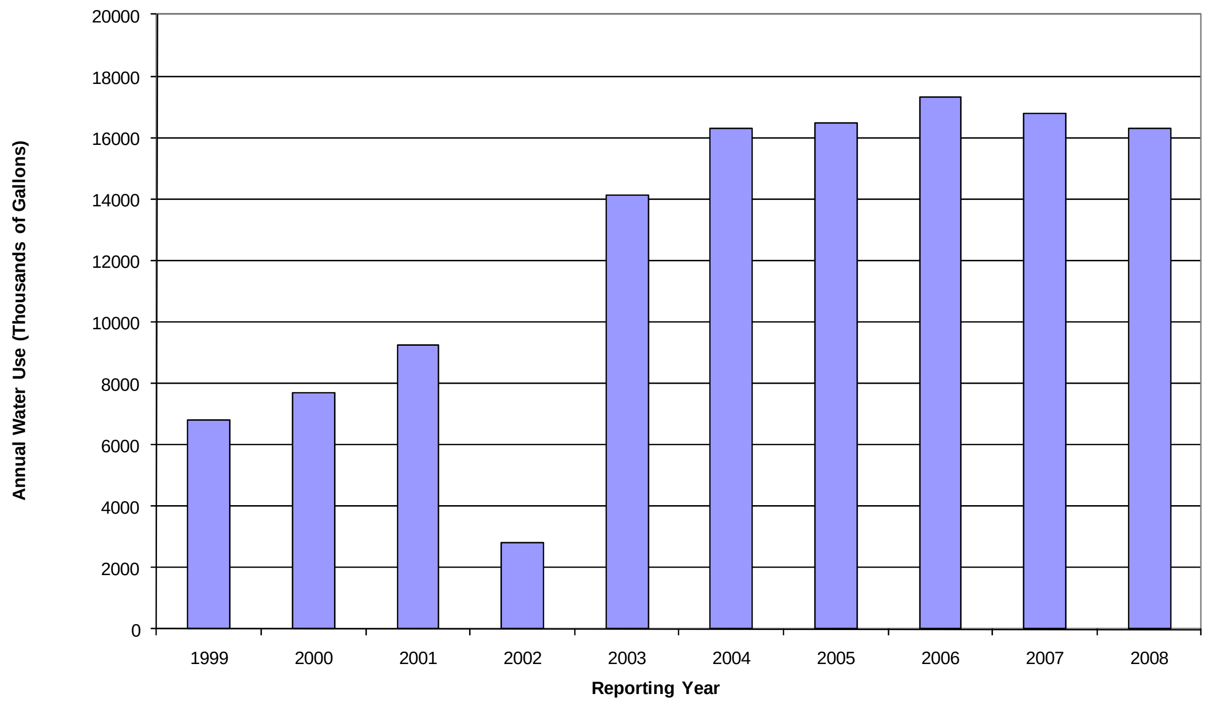


**Figure 2 - Pilgrim Foods, Inc. Annual Water Use, 1999-2008**

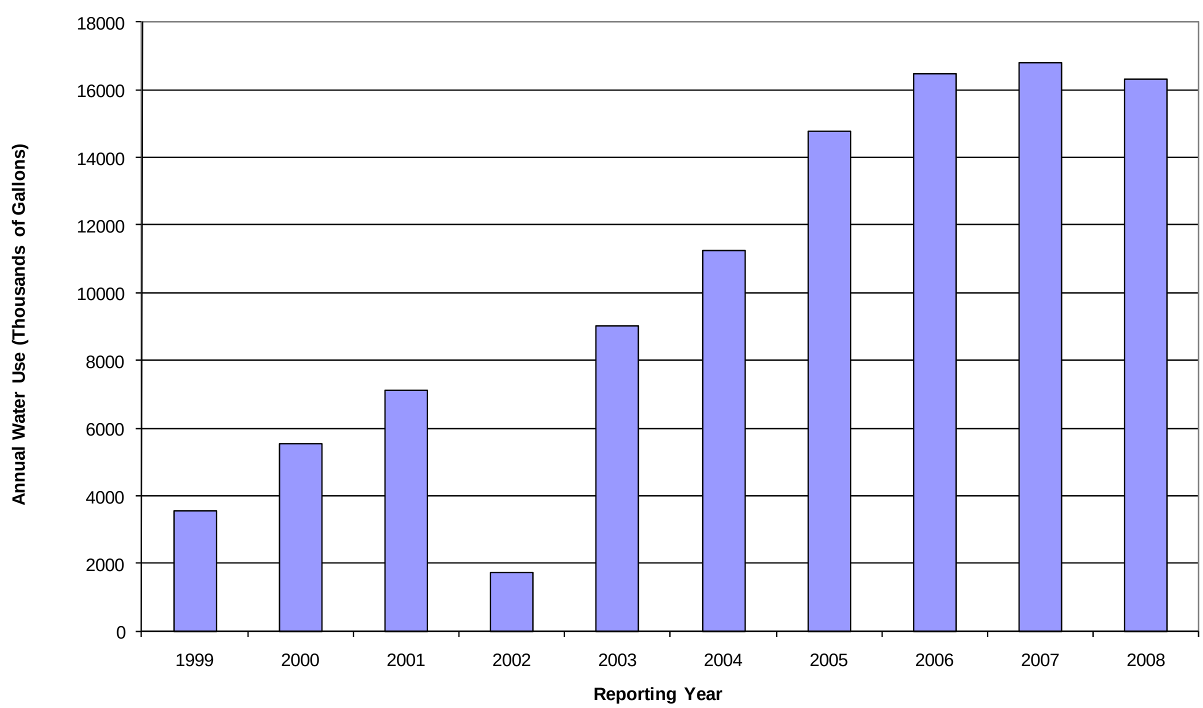


**Figure 3 - Pilgrim Foods, Inc. Greenville Supply Annual Water Use, 1999-2008**

The principal source of water for Pilgrim Foods has been the Town of Greenville water supply (Figure 3), which has been supplemented by water withdrawn from the Souhegan River Well (Figure 4). The plot of the annual water use from the Greenville water supply source closely parallels the plot of the total water use by Pilgrim Foods (Figure 2). As shown in Figure 4, the annual water use of the Souhegan River Well peaked in 2003 and 2004, and then declined in 2005 and 2006. At the end of 2006, the lease that Pilgrim Foods had with the Town for the use of this well expired and they decided not to continue its use. Pilgrim Foods uses the two on-site wells to replace the water formerly withdrawn from the Souhegan River Well and to reduce the amount of water that they purchase from the Town.

According to Pilgrim Foods, approximately 96 percent of the water used goes into their products. Wastewater produced from the food production operations is discharged to two treatment lagoons located on the Pilgrim Foods property and then discharged the Greenville sewer system. Treated wastewater from the Greenville wastewater treatment facility is discharged to the Souhegan Designated River upstream of the Pilgrim Foods facility.

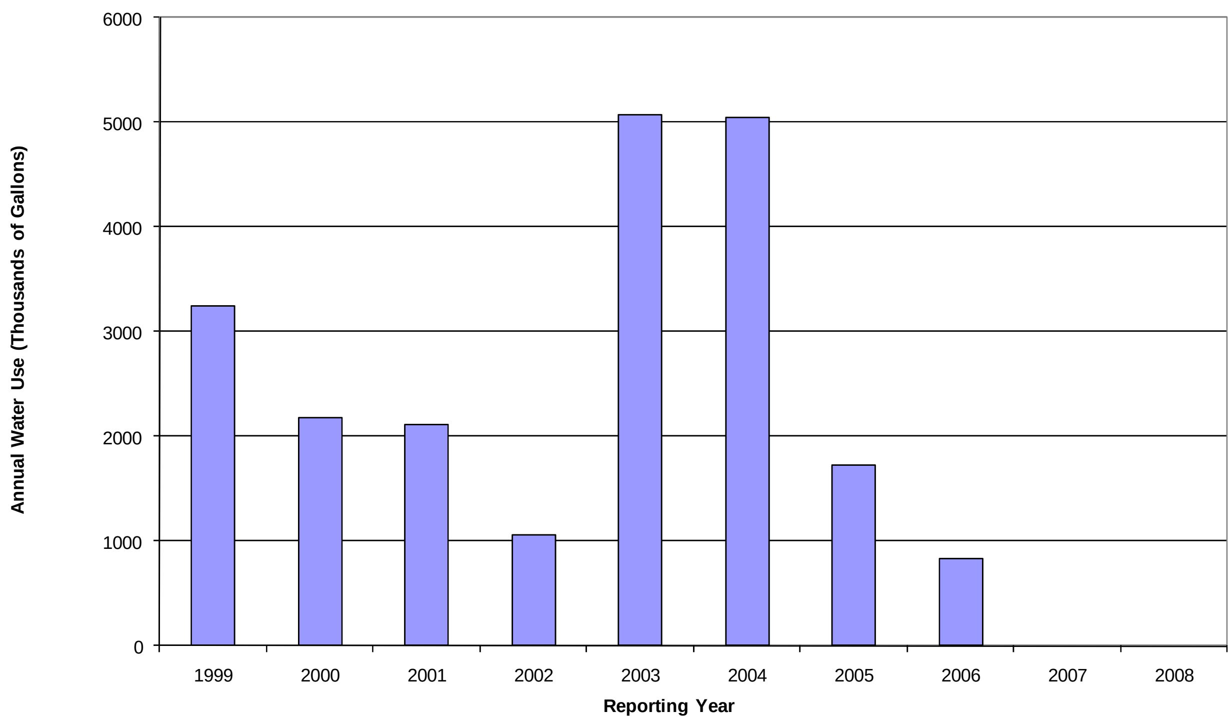


**Figure 4 - Pilgrim Foods, Inc. Souhegan River Well Annual Water Use, 1999-2008**

**Table 1 - Pilgrim Foods, Inc. Annual Water Use Statistics (Combined Sources 1999-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 2,800 | 17,300 | 12,390 |
| **(cfs)** | 0.012 | 0.073 | 0.053 |
| **(cfsm at impact point)** | 0.0004 | 0.0023 | 0.0017 |
| **(cfsm at Merrimack Gage)** | 0.0001 | 0.0004 | 0.0003 |

**Table 2 - Pilgrim Foods, Inc. Greenville Water Supply Annual Water Use Statistics (1999-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 1,750 | 16,790 | 10,260 |
| **(cfs)** | 0.010 | 0.070 | 0.040 |
| **(cfsm at impact point)** | 0.0003 | 0.0022 | 0.0013 |
| **(cfsm at Merrimack Gage)** | 0.00004 | 0.0004 | 0.0003 |

**Table 3 - Pilgrim Foods, Inc. Souhegan River Well Annual Water Use Statistics (1999-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 5,080 | 2,130 |
| **(cfs)** | 0.000 | 0.020 | 0.010 |
| **(cfsm at impact point)** | 0.000 | 0.0006 | 0.0003 |
| **(cfsm at Merrimack Gage)** | 0.000 | 0.0001 | 0.0001 |

From 1999 through 2008, the average monthly water use has varied over a narrow range (500,000 gallons), while the difference between the maximum and minimum monthly water use has been much larger (Figure 5). The main reason for the low minimum monthly water use for the months of January through September is due to the extremely low water use in 2002, the year following the fire at the facility. Historically, the lowest mean monthly water use occurs from November through February because production is reduced is response to a seasonal decline in the demand for their food products.

Since the Greenville water supply is the principal source of water for the facility, its mean monthly water use (Figure 6) and the range of the monthly water use closely parallels that of the use for facility (Figure 5). The average monthly water use from the Souhegan River Well (Figure 7) shows an increasing trend in water use over the year, but within a narrow range (150,000 gallons). Again, Pilgrim Foods stopped using this well as a water supply source after 2006.

Monthly water use data were converted to flow in cubic feet per second (cfs) by dividing the monthly totals by days and then multiplying this result by a flow unit conversion factor (Tables 4, 5 and 6). Based on these converted values, daily water use by Pilgrim Foods has ranged from a minimum of 0.00 cfs (several months of no reported water use) to a maximum of 0.11 cfs (71,742 gallons per day, May 2001), and average use was 0.06 cfs (39,426 gallons per day) for the period of 1999 to 2008 (Table 4).

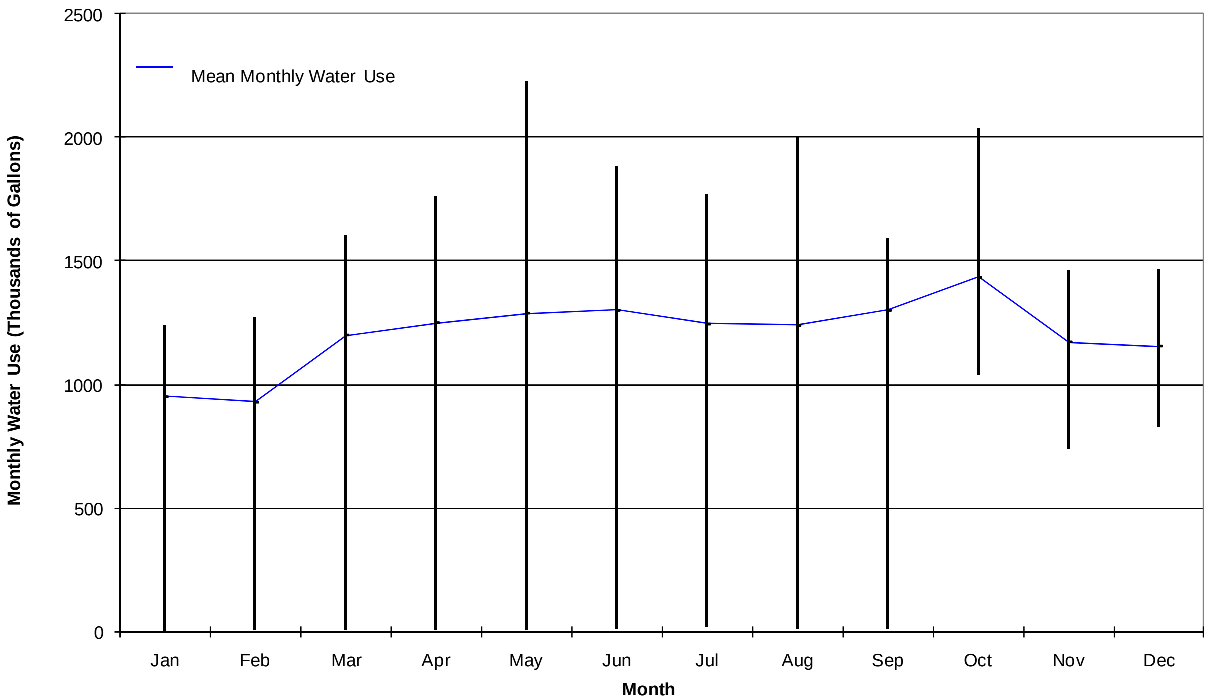


**Figure 5 - Pilgrim Foods, Inc. Monthly Water Use, 1999-2008**

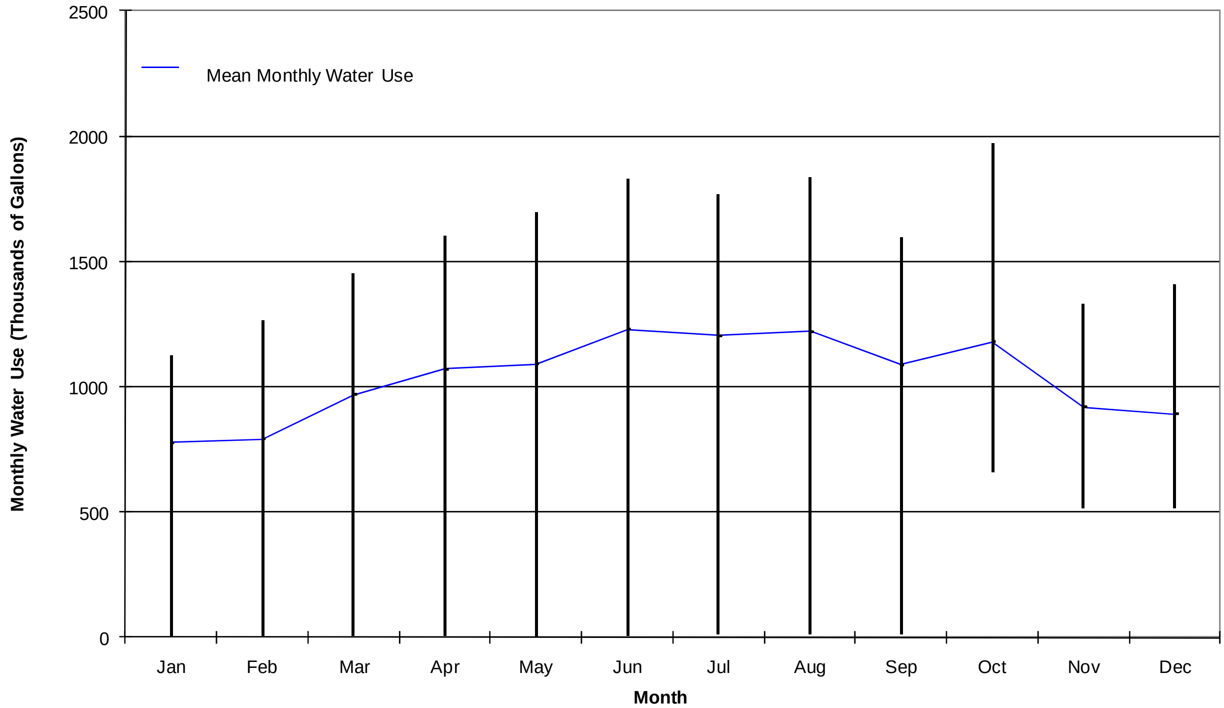


**Figure 6 - Pilgrim Foods, Inc. Greenville Water Supply Monthly Water Use, 1999-2008**

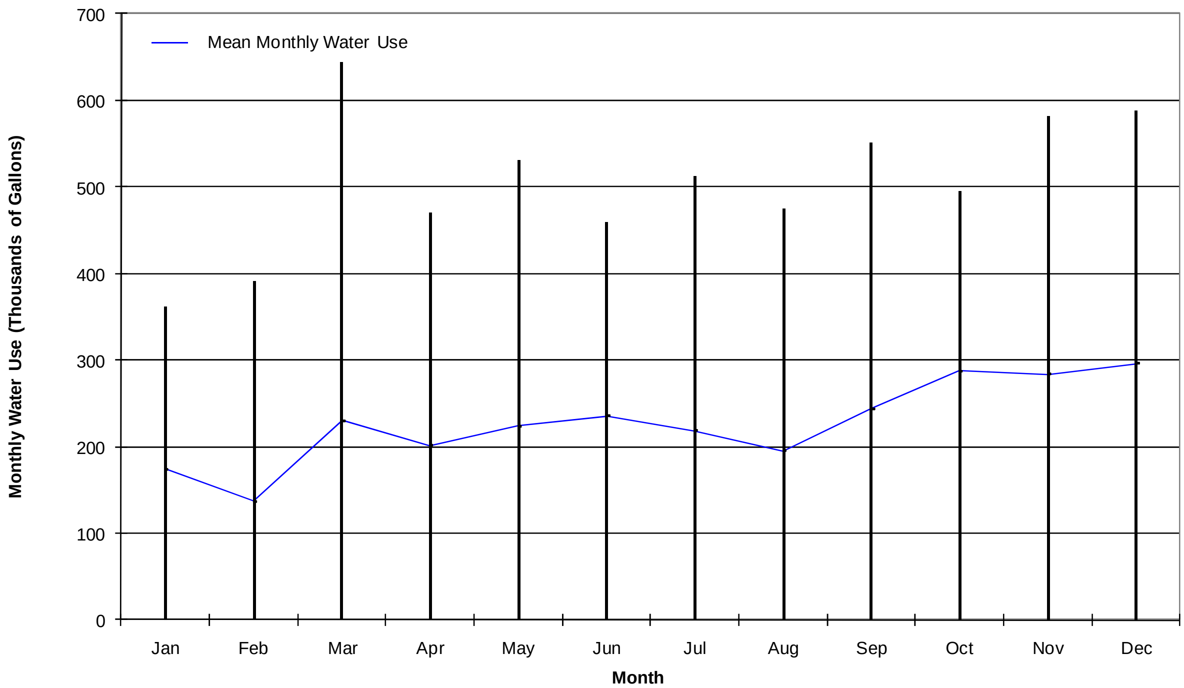


**Figure 7 - Pilgrim Foods, Inc. Souhegan River Well Monthly Water Use, 1999-2008**

**Table 4 - Monthly Water Use Statistics (Combined Sources 1999-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 0 | 2,225 | 1,200 |
| (cfs) | 0.000 | 0.110 | 0.061 |
| (cfsm at impact point) | 0.000 | 0.0035 | 0.0019 |
| (cfsm at Merrimack Gage) | 0.000 | 0.0007 | 0.0004 |

**Table 5 - Monthly Water Use Statistics (Greenville Supply 1999-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 0 | 1,970 | 1,035 |
| (cfs) | 0 | 0.100 | 0.050 |
| (cfsm at impact point) | 0 | 0.0006 | 0.0003 |
| (cfsm at Merrimack Gage) | 0 | 0.0006 | 0.0003 |

**Table 6 - Monthly Water Use Statistics (Souhegan River Well 1999-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 0 | 640 | 230 |
| (cfs) | 0 | 0.030 | 0.010 |
| (cfsm at impact point) | 0 | 0.0009 | 0.0003 |
| (cfsm at Merrimack Gage) | 0 | 0.0002 | 0.0001 |

## Env-Wq 2101 Requirements for Water Conservation Plan

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Water Conservation Rules require different activities depending on the type of water use. Water conservation requirements for industrial water users include: documenting the location and amount of water used for production; installing water meters for each water source; maintaining the meters in accordance with the "Manual of Water Supply Practices, Water Meters – Selection, Installation, Testing, and Maintenance" (AWWA 1999); and, documenting use of the water conservation best management practices or best available technologies applicable at the facility.

## Existing Water Conservation Measures

Each of Pilgrim Foods water sources is metered. Pilgrim Foods purchases some of its water from the Town and the Town is responsible for the proper operation and maintenance of Pilgrim Foods water meter. In 2009, Pilgrim Foods began using its two on-site water supply wells to supplement the water purchased from the Town. Each well is metered and, pursuant to the Water Use Registration and Reporting Rules (Env-Wq 2102), each meter needs to be calibrated and maintained in accordance with the specifications of the meter manufacturer for the full range of the withdrawal.  All meters must be operated and maintained to within an accuracy of 10 percent.

Pilgrim Foods has not performed a water use and conservation audit of its operations, which is an important tool to determine the present water uses, water losses and conservation practices such that improvements in water conservation and water efficiency can be identified and implemented.

**Water Conservation Alternatives and Costs**

Pilgrim Foods must operate and maintain its existing water meters to comply with the requirements of the Water Use and Reporting Rules (Env-Wq 2102).  To identify potential water efficiency improvements and water conservation measures, Pilgrim Foods should perform a water audit of its operations.

**Conservation Implementation Schedule**

By June 1, 2014, Pilgrim Foods will finalize a Water Conservation Plan in accordance with Env-Wq 2101 in order to meet the Instream Flow Rule (Env-Wq 1900) requirements for a conservation plan.  The Water Conservation Plan will document Pilgrim Foods' existing water conservation activities, maintenance of the source water meters in accordance with the provisions of the Water Conservation Rules, and implementation of water conservation best management practices and best available technologies where economically feasible.

**Water User Contact Information**

**Water User**: Pilgrim Foods, Inc.
**Address**: 68 Old Wilton Road, Greenville, NH 03048-3100
**Contact**: Charles Santich
**Phone**: 878-2100
**Email**: charlies@pilgrimfoods.net

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 1201 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

American Water Works Association (AWWA) 1999. Water Meters – Selection, Installation, Testing and Maintenance. Manual of Water Supply Practices M6. Fourth Edition.

Department of Environmental Services (DES) 2010. Performing a Business or Industry Water Use and Conservation Audit. Environmental Fact Sheet WD-DWGB-26-16.

Personal communication with Charles Santich, Pilgrim Foods.

Personal communication with Ingrid Sweeney, Pilgrim Foods.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc.

Water use reports on file with the Department of Environmental Services (DES).

**CONSERVATION PLAN**

**Pine Valley Mill Dam (#20782)**

## Introduction

Conservation plans under the Instream Flow Program require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

Pine Valley Mill Dam is located on the main stem of the Souhegan River in Wilton, New Hampshire (Figure 1). The dam is a privately owned hydropower facility. According to DES Dam Bureau records, the concrete dam is 200 feet long and 23 feet high (Figure 2). The dam impounds a water body less than 10 acres in size used locally for recreation.

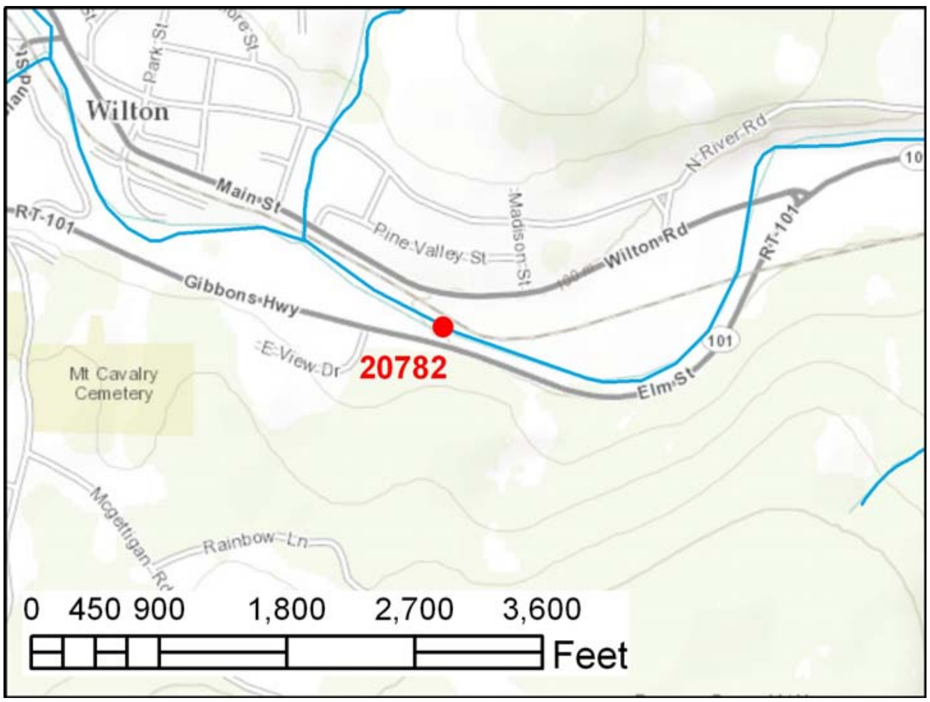


**Figure 1 – Location map of Pine Valley Mill Dam, Wilton, New Hampshire.**

## Water Source and Uses

The hydropower operations at Pine Valley Mill Dam are dependent on stream flow in the Souhegan River. The dam is operated as run-of-river, meaning that the operation of the dam does not alter the flow of the river and all of the water diverted through the hydroelectric operations is returned to the river. The return point (#20782-D01) is located approximately 0.6 miles downstream of the dam at a former mill building between Wilton Road and North River Road located in Milford, New Hampshire (Figure 1).

The hydroelectric operations use water 24 hours per day, year round.  The only flow restrictions on the facility are a Federal Energy Regulatory Commission (FERC) permitted minimum instream flow of 25 cfs and a minimum production flow of 15 cfs, for a total minimum flow restriction of 40 cfs.  When electricity is not being produced by the facility, flow either goes over the dam and/or through the bypass pipe on the north side of the dam, but not through the penstock.

**Figure 2 - Pine Valley Mill Dam, Wilton, New Hampshire looking upstream from the south bank (2005)**

## Water Use Patterns

Water use data for the Pine Valley Mill Dam for the period of 2005 through 2008 are show graphically in Figures 3 and 4 and summarized in Tables 1 and 2.

Water use is dependent on river flow.  On an annual basis, Pine Valley Mill Dam water use has ranged from a high of 21,400 million gallons (2006) to a low of 11,500 million gallons in 2007 (Figure 3 and Table 1).  Average annual water use was 18,200 million gallons for 2005 through 2008.  During this period, annual water use has not shown significant upward or downward trends.

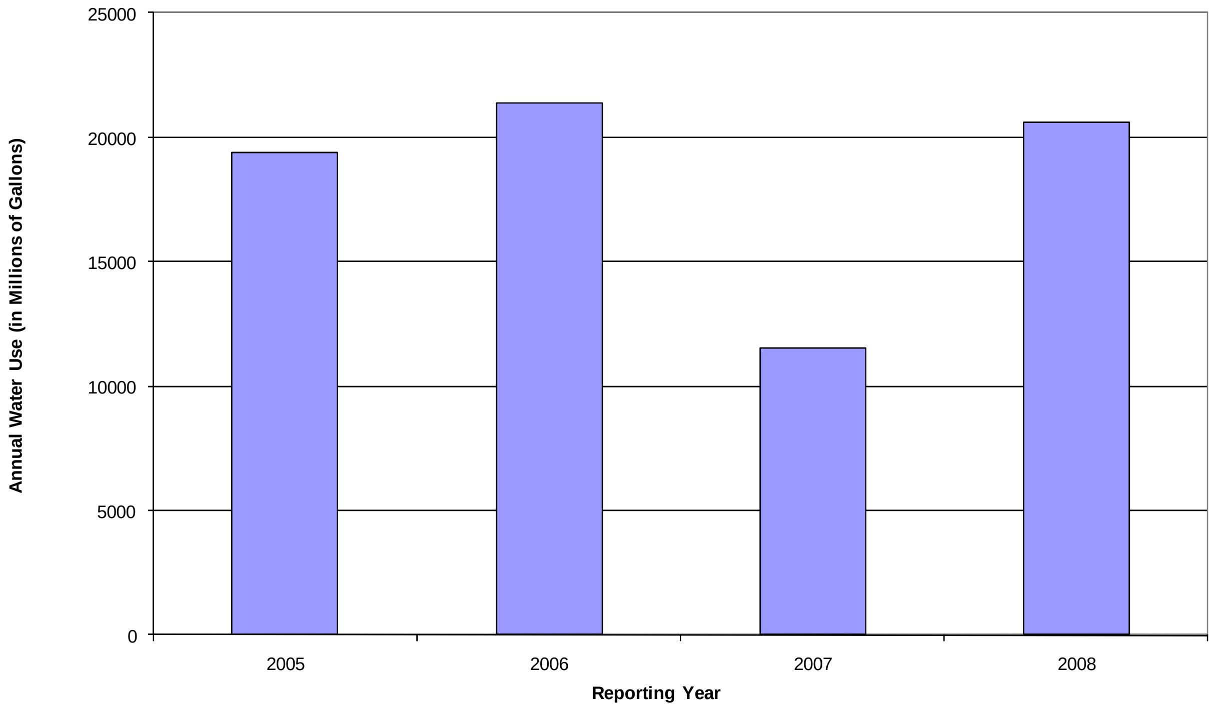


**Figure 3 - Pine Valley Dam Annual Water Use, 2005-2008**

**Table 1 - Annual Water Use Statistics (2005-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 11,500 | 21,400 | 18,200 |
| **(cfs)** | 48.9 | 90.8 | 77.3 |
| **(cfsm at impact point)** | 0.482 | 0.895 | 0.762 |
| **(cfsm at Merrimack Gage)** | 0.286 | 0.531 | 0.452 |

Minimum monthly water use at Pine Valley Mill Dam during this period was 0 gallons (July 2007, August 2005 and September 2006), with a maximum of 3,360 million gallons (January 2006), and an average of 1,500 million gallons (Figure 4 and Table 2). The four years of reported data show monthly water use to be variable and typically follows the normal river flow. Peak usage occurs during April (2,580 million gallons) and minimum usage occurs during August (195 million gallons), which is typical of a run-of-river hydroelectric dam in New Hampshire.

The monthly use data, in thousands of gallons, were converted to cubic feet per second. Daily water use by the Pine Valley Mill Dam has ranged from a minimum of 0 cfs (July 2007, August 2005 and September 2006) to a maximum of 168.0 cfs (January 2006), and average use was 76.6 cfs for the period of 2004 to 2008.

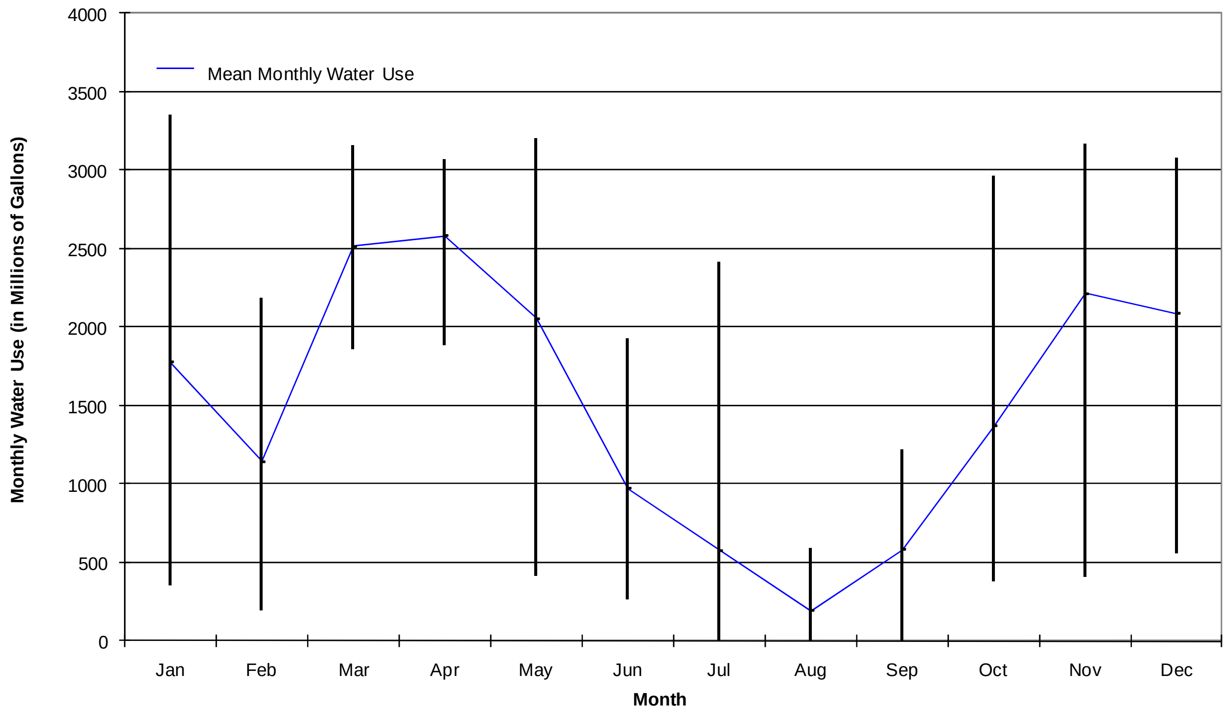


**Figure 4 - Pine Valley Dam Monthly Water Use, 2005-2008**

**Table 2 - Pine Valley Dam Monthly Water Use Statistics (2004-2008)**

| | Low | High | Average |
|---|---|---|---|
| (million gal) | 0 | 3,360 | 1,500 |
| (cfs) | 0 | 168.0 | 76.6 |
| (cfsm at impact point) | 0 | 1.650 | 0.755 |
| (cfsm at Merrimack Gage) | 0 | 0.980 | 0.448 |

## Env-Wq 2101 Requirements for Water Conservation Plan

Development and approval of a water conservation plan that meets the Water Conservation Rules (Env-Wq 2101) requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. Since the Pine Valley Mill Dam is hydroelectric power facility with no consumptive use, a Water Conservation Plan is not required.

## Existing Water Conservation Measures

Since Pine Valley Mill Dam is managed as a run-of-river operation, no water conservation measures are required at this facility.

## Water Conservation Alternatives and Costs

Since the facility is operated on a run-of-river basis and since there are no consumptive losses associated with its operations, no additional water conservation measures are currently required.

**Conservation Implementation Schedule**

Since no additional water conservation measures are currently required, there is no conservation implementation schedule.

**Water User Contact Information**

**Water User**: Pine Valley Business Center
**Address**: 37 Wilton Road, Milford, NH, 03055
**Contact**: Lisa Morrison
**Phone**: 880-6655
**Email**: Not available

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
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| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information:**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

New Hampshire Dam Bureau, NHDAMS Data Sheet for Pine Valley Hydro Mill Dam.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc and completed by Paul Robichaud of Milford Elm Street Trust.

Water use reports on file with the Department of Environmental Services (DES).

**CONSERVATION PLAN**

**Savage Municipal Water Supply Superfund Site (#20833)**

## Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

The Savage Municipal Water Supply Superfund Site (Savage Well site) is a CERCLA hazardous waste site located in Milford, New Hampshire. Two different registered water users are associated with the ongoing remedial activities at the Savage Well site. One of the registered water users is the OK Tool Source Area (#20832), which is located to the west of this site and is discussed in a separate Conservation Plan. The Savage Well site includes an active groundwater pump and treatment system where groundwater contaminated by volatile organic compounds (VOCs) down-gradient of the OK Tool Source Area are removed, treated and then re-infiltrated to the Souhegan River aquifer via underground injection or is discharged directly into the Souhegan River. The Savage Well site remediation activities are the responsibility of the Potentially Responsible Parties (PRPs) and are covered under an existing remediation plan.

## Water Source and Uses

The Savage Well site covers the groundwater contamination plumes in the Souhegan River aquifer between the OK Tool Source Area and the Souhegan River. Groundwater is extracted from a wellfield (20833-S01) that consists of three wells in the plume area. The water is treated for VOCs via air stripping and returned to the aquifer upgradient of the extraction wells through a wellfield (20833-D01) that consists of three injection wells. During times of high groundwater levels, treated water is also discharged directly to the Souhegan River via a surface water discharge (20833-D02). Figure 1 depicts the location of the extraction and injection wellfields and surface water discharge with respect to the Souhegan River. The drainage area of the Souhegan River at the location of these wells is 104 sq. mi.

## Water Use Patterns

Water use is nearly continuous during treatment operations and the wells are generally pumped at a uniform rate of 25 gallons per minute (gpm). Groundwater pumping is metered, recorded monthly, and reported to DES.

According to the water use registration forms on file with DES, the extraction wells are typically pumped at a constant rate of 648,000 gallons per day (gpd) with an average annual use of 236,520,000 gallons. The water pumped from the extraction wells is either returned to the aquifer through underground injection or discharged directly into the Souhegan River; thus, there is no net water consumption at this site. Water use data for the extraction wellfield for the year 2008 are shown graphically in Figure 2 and summarized in Table 1. The monthly water use data

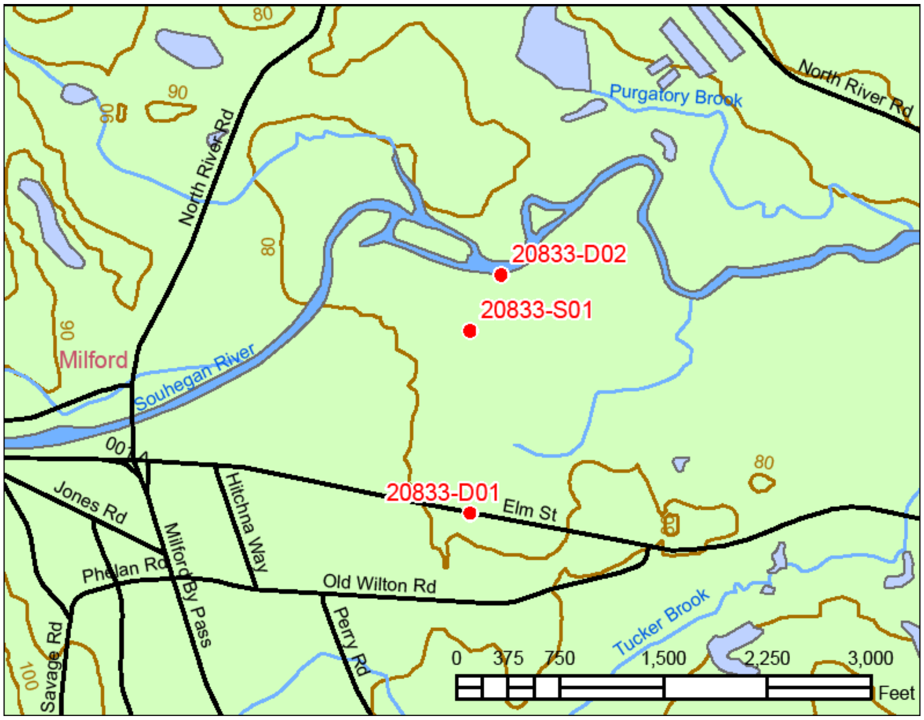


**Figure 1 - Location map of Savage Well Superfund Site, Milford, New Hampshire**

were converted to flow in cubic feet per second by dividing the monthly totals by days and then multiplying this result by a flow unit conversion factor.

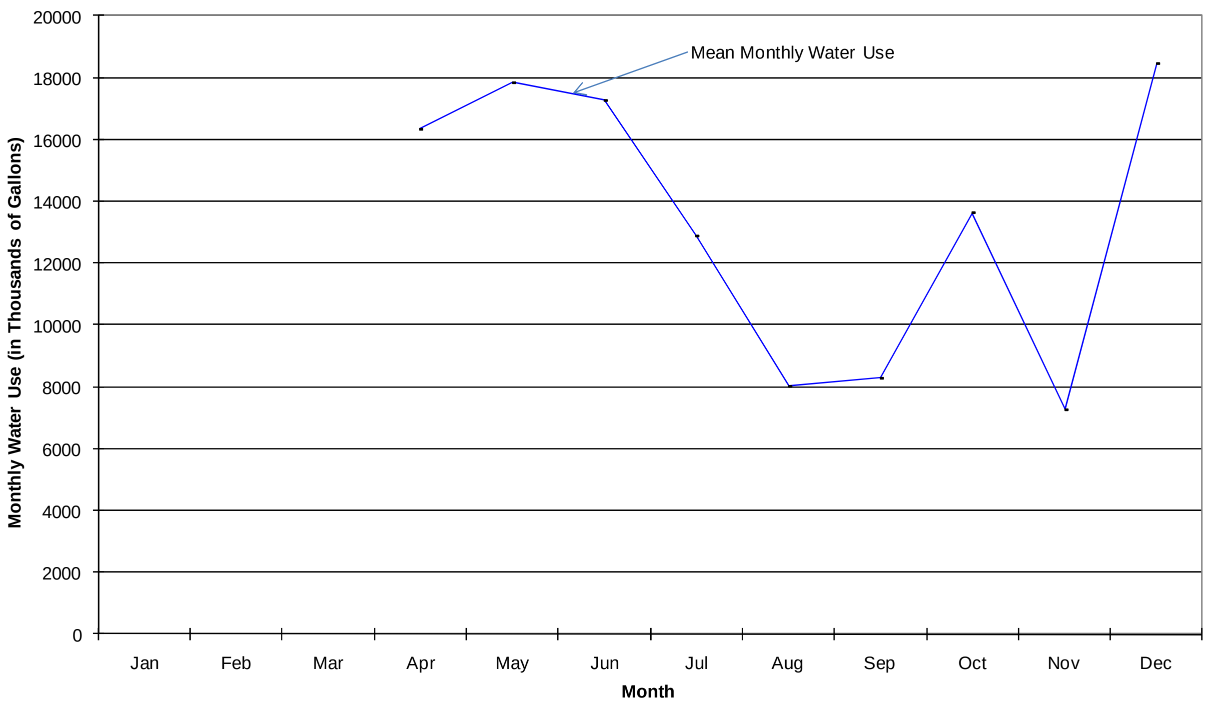


**Figure 2 - Savage Well Site Monthly Water Use for 2008**

**Table 1 - Savage Well Site Monthly Water Use Statistics for 2008**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 7,300 | 18,400 | 13,300 |
| (cfs) | 0.3746 | 0.9210 | 0.6750 |
| (cfsm at impact point) | 0.0036 | 0.0088 | 0.0065 |
| (cfsm at Merrimack Gage) | 0.0022 | 0.0054 | 0.0039 |

## Env-Wq 2101 Requirements for Water Conservation Plans

The development and approval of a water conservation plan that meets the Water Conservation Rules (Env-Wq 2101) is a requirement under the Instream Flow Rules (Env-Wq 1900). Water use at the Savage Well Superfund Site is for the remediation of contaminated groundwater. The laws and rules that are to govern its operations have been specified during the Superfund settlement. The Instream Flow Rules were not included in that settlement. The water is returned to groundwater through an injection wellfield or to the Souhegan River. Any pipe losses would also return to groundwater. Following discussion with the Affected Water Users, following Env-Wq 1906.02(d) (1) of the Instream Flow Rules, no conservation measures are to be implemented.

## Existing Water Conservation Measures

Meters are installed on the groundwater extraction wells. Contaminated water is transmitted via double lined pipes to the treatment facility. The treated water is returned to the aquifer and to the Souhegan River. Water returned to groundwater is estimated for each injection well and the remainder is attributed to the return to the Souhegan River.

## Water Conservation Alternatives and Costs

The remediation activities at the Savage Well site are specified in a remedial operations plan overseen by DES and the United States Environmental Protection Agency (EPA). Water is withdrawn and returned to the aquifer or to the Souhegan River. Following discussions with legal representatives for the Affected Water User, it was agreed that no additional conservation measures are to be implemented.

## Conservation Implementation Schedule

Since no additional conservation measures are currently required for the Savage Well Superfund Site, there is no implementation schedule.

## Water User Contact Information

**Water User**: Hitchner Manufacturing Co. Inc. & Thomas & Betts Corp.
**Address**: McLane, Graf, Raulerson & Middleton, PA, Suite 500, 11 South Main Street, Concord, NH, 03301
**Contac**t: Greg Smith
**Phone**: 230-4401
**Email**: gsmith@mclane.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

## Sources of Information

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/29/03.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

Water use registration forms on file with the Department of Environmental Services (DES).

Waste Site Cleanup & Reuse in New England – Savage Municipal Water Supply, United States Environmental Protection Agency. website: http://yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/83c7d221bb30028c8525691f0063f6f4!OpenDocument

**CONSERVATION PLAN**

**Souhegan Woods Golf Club (#20523)**

## Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

The Souhegan Woods Golf Club is located off of Thornton Ferry Road in Amherst, New Hampshire. This 18-hole golf course was built in 1991 and is open to the public.

## Water Source and Uses

The Souhegan Woods Golf Club has a registered withdrawal (20523-S01) from the Souhegan Designated River, which is the source of irrigation water for the golf course operations (Figure 1). Water is withdrawn from the river via a suction line that extends approximately 15 feet out from the shore and approximately six feet below the water surface (Figure 2). This intake is located in the Town of Amherst approximately 6.3 miles upstream from the confluence of the Souhegan with the Merrimack River. The drainage area of the Souhegan River at the point of withdrawal is approximately159 sq. miles.

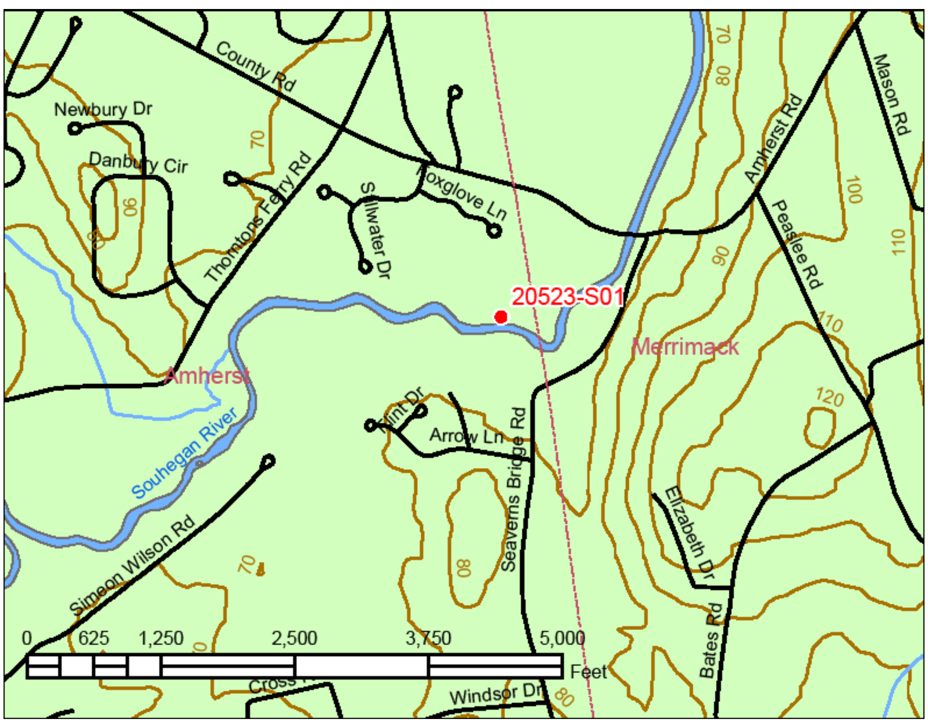


**Figure 1 – Location Map of the Souhegan Woods Golf Club's Souhegan River Intake, Amherst, New Hampshire**

**Figure 2 – Photograph of the Souhegan Woods Golf Club Souhegan River Intake (June 2004)**

Water is withdrawn on an "as needed" basis, which is defined as the minimum amount of water necessary to maintain healthy turf as determined through the physical monitoring of soil moisture levels. Water withdrawn from the river by the Souhegan Woods Golf Club is used to irrigate 70 acres of golf course fairways and greens and for equipment cleaning. Irrigation of the courses is necessary to ensure that the various grasses used at the courses remain healthy and adequately watered and to meet user expectations in terms of course appearance, condition and "playability."

**Water Use Patterns**

Water use is metered, recorded monthly and reported to DES annually. A new recording meter was installed in April 2009 and the meters are checked and calibrated each spring upon start-up.

As noted, water use is on an as needed basis, varying from every day to twice a week, with the greatest use during the spring through the fall, but is also weather dependent. Weather conditions are monitored using information from local weather stations. Irrigation is typically performed daily from 8 pm to 6 am. However, very dry conditions or mechanical failure of the irrigation system may require occasional daytime irrigation.

Water use data for the Souhegan Woods Golf Club for the years of 1991 through 2008 were obtained from DES and are presented in Figures 3 and 4 and summarized in Tables 1 and 2. The tables include the conversion of water use from thousands of gallons to cubic feet per second (cfs), as well as to cubic feet per second per square mile of the drainage area to allow for comparison with stream flow values reported for the Souhegan Designated River.

Between 1991 and 2008 annual water use has varied from a low of 17.4 million gallons (2003) to a high of over 56.8 million gallons (2001), averaging 34.9 million gallons for the reporting period (Figure 3 and Table 1). During this period annual water use increased by 7.27 million gallons or 27 percent. This represents an average increase of 404,000 gallons per year or 1.5 percent per year.

From 1991 to 2001 annual water use increased by 112 percent, but declined from 2001 to 2003 due to changes in water use management to increase water use efficiency. These changes included the introduction of new turf grasses and wetting agents and improvements in the pumping operations. Water use increased again between 2003 and 2008.

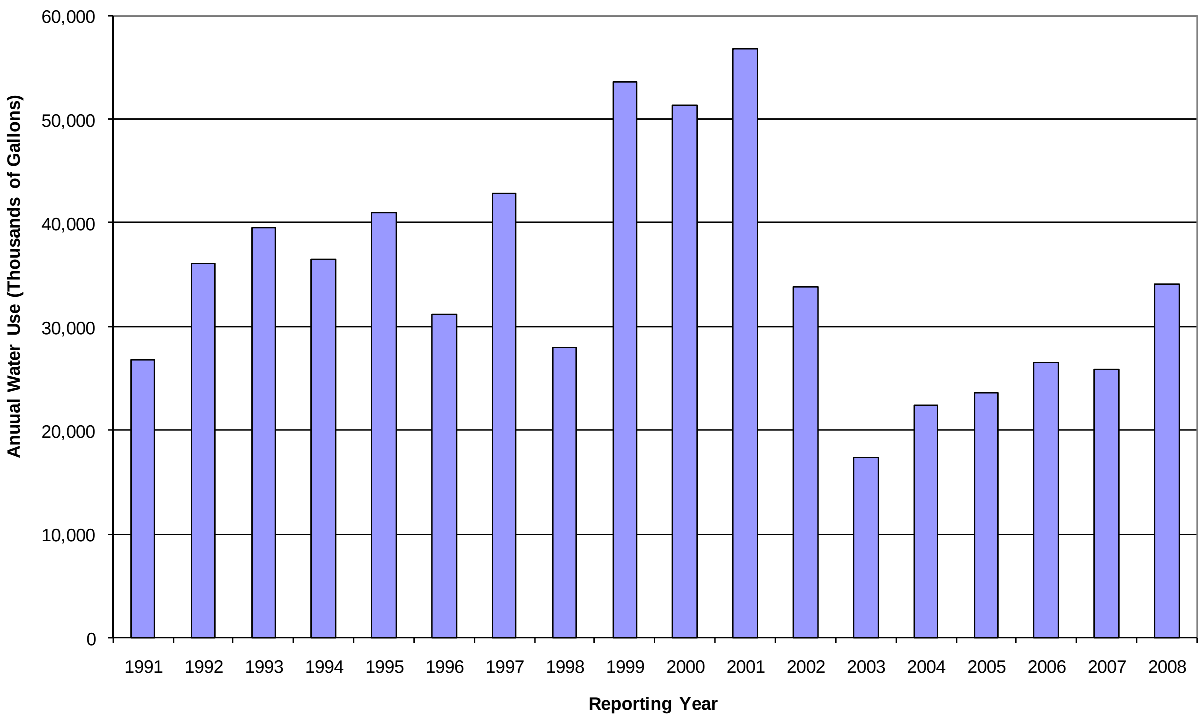


**Figure 3 – Souhegan Woods Golf Club Annual Water Use 1991-2008**

**Table 1 – Souhegan Woods Golf Club Annual Water Use Statistics (1991-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 17,400 | 56,800 | 34,900 |
| (cfs) | 0.0740 | 0.2410 | 0.1480 |
| (cfsm at impact point) | 0.0005 | 0.0015 | 0.0009 |
| (cfsm at Merrimack Gage) | 0.0004 | 0.0014 | 0.0009 |

Water withdrawals typically begin in April, but have occasionally occurred in March (six years), increase to a maximum in July, then decline and typically end by November (Figure 4). The range in monthly water use reflects the weather conditions that affect the water demand by the golf course turf. Total monthly water use for the reporting period has ranged from 0 (multiple occurrences) to 16.3 million gallons (August 2001, a period of drought) and averaged 2.89 million gallons per month over the year (Table 2). When averaged for just the April-October period, average monthly water use was 4.93 million gallons.

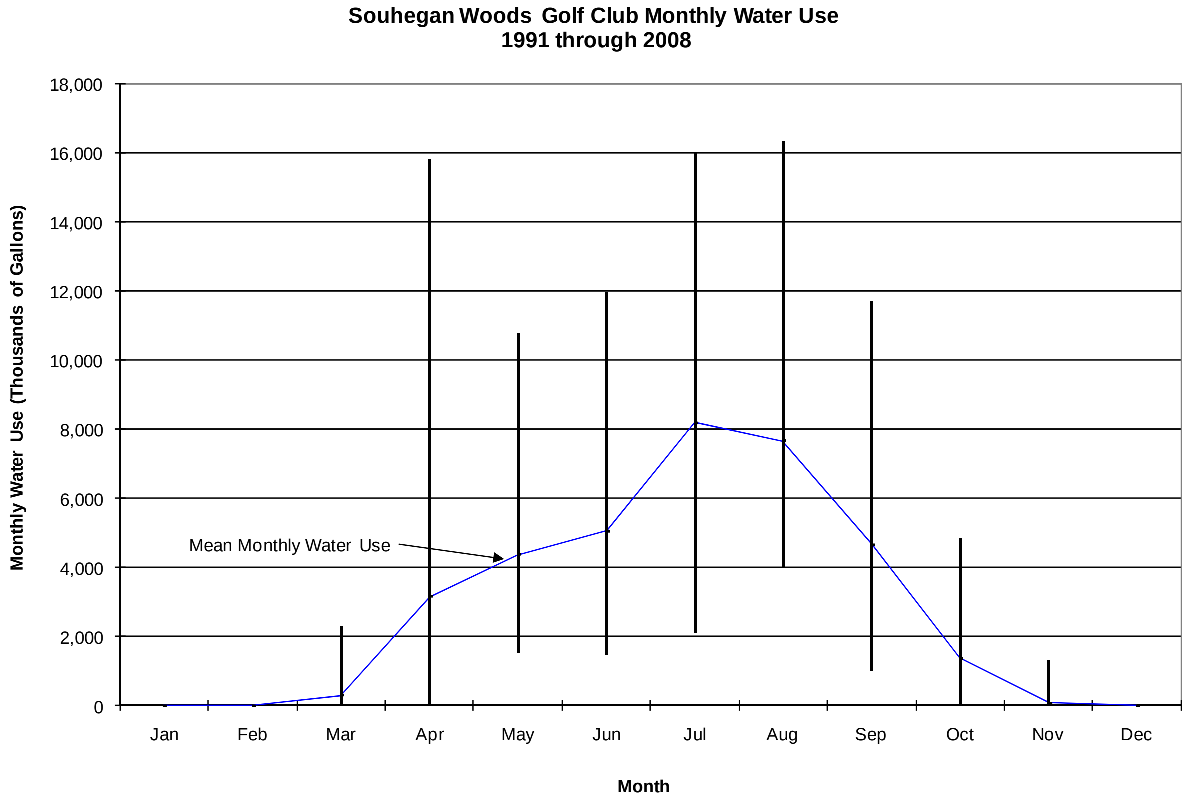


**Figure 4 – Souhegan Woods Golf Club Monthly Water Use, 1991-2008.**

**Table 2 – Souhegan Woods Golf Club Monthly Water Use Statistics (1991-2008)**

| | Low | High | Average | Apr-Oct avg |
|---|---|---|---|---|
| (thousand gal) | 0 | 16,300 | 2,890 | 4,930 |
| (cfs) | 0 | 0.816 | 0.147 | 0.249 |
| (cfsm at impact point) | 0 | 0.0051 | 0.0009 | 0.0016 |
| (cfsm at Merrimack Gage) | 0 | 0.0048 | 0.0009 | 0.0015 |

Monthly water use data were converted to flow in cubic feet per second (cfs) by dividing the monthly totals by days and then multiplying this result by a flow unit conversion factor. Based on these values, the water use by the Souhegan Woods Golf Club has ranged from a minimum of 0 cfs (December through February in all years, November in all but one year (1999), ten years in March, two years in April and October) to a maximum of 0.816 cfs (during August 2001) with an average of 0.249 cfs for the April – October period and 0.147 cfs annually during the past 17 years (Table 2).

**Env-Wq 2101 Requirements for Water Conservation Plans**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Conservation Rules require different activities depending on the type of water use. As a commercial water user, Souhegan Woods Golf Club needs to maintain its source water meter in accordance with the "Manual of Water Supply Practices, Water Meters – Selection, Installation, Testing and Maintenance" (AWWA 1999), follow water conservation best management practices developed for golf courses, and use best available water conservation technologies.

**Existing Water Conservation Measures**

The management of the Souhegan Woods Golf Club is aware of and adheres to the water efficiency practices for golf courses recommended by DES. Several basic water conservation measures are used at the Souhegan Woods Golf Club. To minimize water use irrigation is only conducted when needed and is done in the evening and overnight to reduce evapotranspiration losses. The need for irrigation is based on manual soil moisture monitoring, turf conditions and weather. Souhegan Woods Golf Club has upgraded their irrigation system for evapotranspiration-based watering to further improve their water use efficiency.

Extensive efforts are made to monitor water use. Water meters are checked and calibrated each spring upon start up to ensure that accurate water use data are collected. To identify irrigation system leaks, visual inspections of the golf course are performed each morning and throughout the day along with pressure monitoring within the pump house.

Additional water efficiency practices employed by Souhegan Woods Golf Club include proper turf/soil cultivation techniques such as: aeration, verticutting, top-dressing, soil analyses and use of wetting agents.

**Water Conservation Alternatives and Costs**

Souhegan Woods Golf Club has implemented many of the water efficiency practices recommended by DES in its Environmental Fact Sheet WD-DWGB-26-6, Water Efficiency: Golf Courses. The implementation of these practices has led to a significant overall reduction in water use since 2001. These practices should be continued, and expanded as appropriate, to further conserve water as part of its normal business operations.

**Conservation Implementation Schedule**

By June 1, 2014, the Souhegan Woods Golf Club will finalize a Water Conservation Plan in accordance with Env-Wq 2101 in order to meet the Instream Flow Rule (Env-Wq 1900) requirements for a conservation plan. The Water Conservation Plan will document the Souhegan Woods Golf Club's existing water conservation activities.

**Water User Contact Information**

**Water User**: Souhegan Woods Golf Club
**Address**: 65 Thorton Ferry Road II, Amherst, NH, 03031
**Contac**t: Ryan Lane, Superintendent
**Phone**: 424-4122
**Email**: rustyone33@yahoo.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

## Sources of Information


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

American Water Works Association (AWWA) 1999. Water Meters – Selection, Installation, Testing and Maintenance. Manual of Water Supply Practices M6.

Department of Environmental Services (DES) 2013. Water Efficiency: Golf Courses. Environmental Fact Sheet WD-DWGB-26-6 (http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-26-6.pdf).

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Ryan Lane, Souhegan Woods Golf Club.

Personal communication with Ryan Lane, Souhegan Woods Golf Club.

Water use reports on file with the Department of Environmental Services (DES).

**CONSERVATION PLAN**

**Waterloom Falls Dam (#20228)**

## Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

Waterloom Falls Dam is located on the main stem of the Souhegan River in New Ipswich, New Hampshire (Figure 1). The dam is a privately owned hydropower facility licensed by the Federal Energy Regulatory Commission (FERC Project No. 7920) and registered with the DES Dam Bureau (#175.09). According to the records of the DES Dam Bureau, the concrete and stone dam is 214 feet long and 22.5 feet high (Figure 2). The dam impounds Waterloom Pond, which is 75 acres and used locally for recreation.

## Water Source and Uses

The hydropower operations at Waterloom Falls Dam are dependent on the stream flow in the Souhegan River, and are thus registered with the DES as a water user (20228). Water use is reported quarterly. The dam is operated as run-of-river, meaning that the operation of the dam does not alter the flow of the river and all of the water diverted through the hydroelectric operations is returned to the river 75 feet downstream of the dam via a penstock.

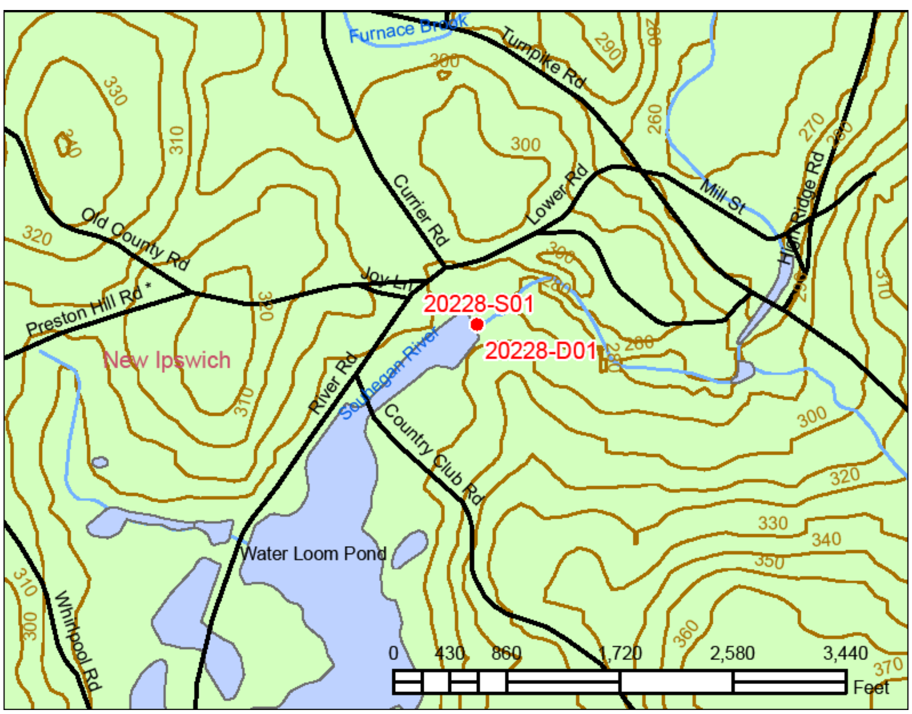


**Figure 1 – Location map of the Waterloom Falls Dam, New Ipswich, New Hampshire.**

If sufficient flow is available, the hydroelectric operations at Waterloom Falls Dam can produce power 24 hours a day, seven days a week, 365 days a year. Under the terms of its license to operate, the facility must allow for a minimum outflow of 10 cubic feet per second (cfs) during the summer (June through September) and 15 cfs the rest of the year. When the hydropower facility is not operating, all of the flow goes over the dam's spillway (Figure 2).

**Figure 2 - Waterloom Falls Dam, New Ipswich, New Hampshire (June 2005)**

## Water Use Patterns

Water use data for the Waterloom Falls Dam for the period of 1989 through 2008 re shown graphically in Figures 3 and 4 and are summarized in Tables 1 and 2.

Water use is dependent on river flow. On an annual basis, Waterloom Falls Dam water use has ranged from a low of 2,760 million gallons (2001) to a high of 6,680 million gallons in 1996 (Figure 3 and Table 1). Average annual water use was 4,890 million gallons for the sixteen years that a complete annual record was available. Annual water use has not shown significant upward or downward trends and has mirrored water usage at other Souhegan River dams.

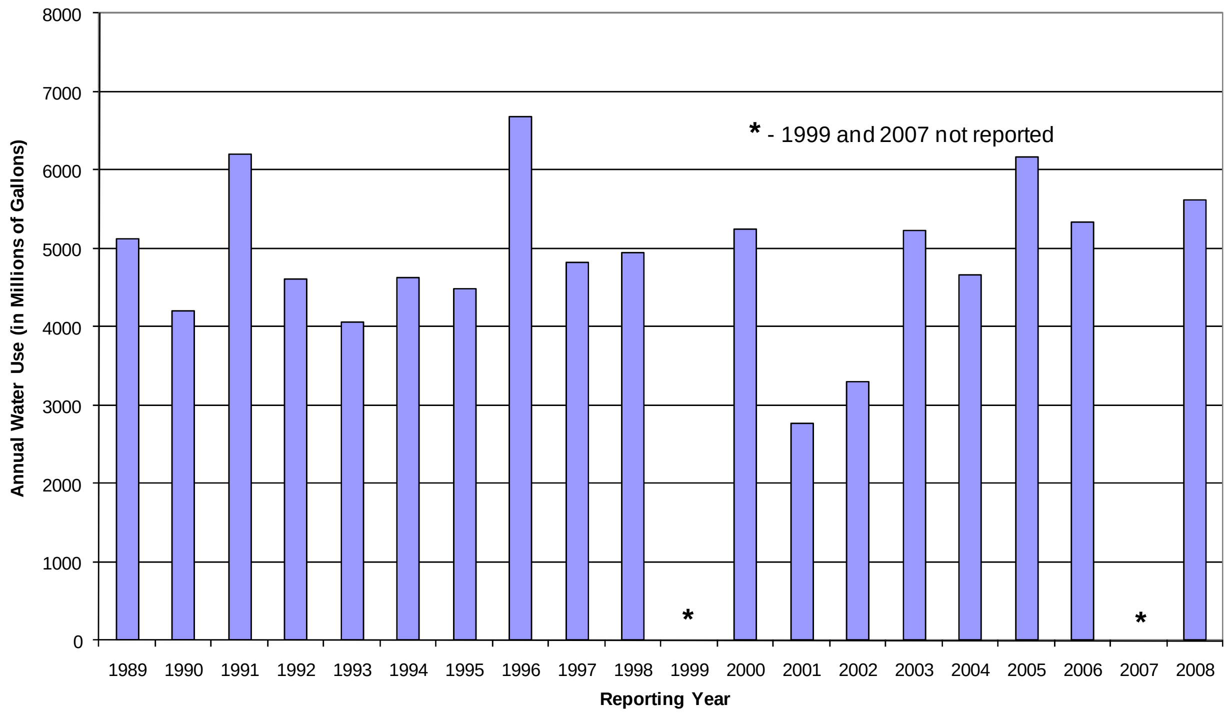


**Figure 3 - Waterloom Falls Dam Annual Water Use, 1989-2008**

**Table 1 - Annual Water Use Statistics (1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 2,760 | 6,680 | 4,890 |
| **(cfs)** | 11.70 | 28.30 | 20.80 |
| **(cfsm at impact point)** | 0.5180 | 1.2500 | 0.9170 |
| **(cfsm at Merrimack Gage)** | 0.0686 | 0.1660 | 0.1210 |

Minimum monthly water use at Waterloom Falls Dam was 416,000 gallons (July, August and September 1990) with a maximum of 951 million gallons (April 2008) and an average of 408 million gallons (Figure 4 and Table 2). Generally, monthly water use ranges between 360 and 460 million gallons per month. Greatest monthly usage is usually during April when river flows are greatest, which is typical for a run-of-river dam in New Hampshire.

Monthly water use data, in thousands of gallons per month, were converted to cubic feet per second. Based on these converted values, daily water use by the Waterloom Falls Dam has ranged from a minimum of 0.02 cfs (July and August 1990) to a maximum of 49.10 cfs (April 2008), and average use was 20.80 cfs for the period of 1989 to 2008 (Table 2).

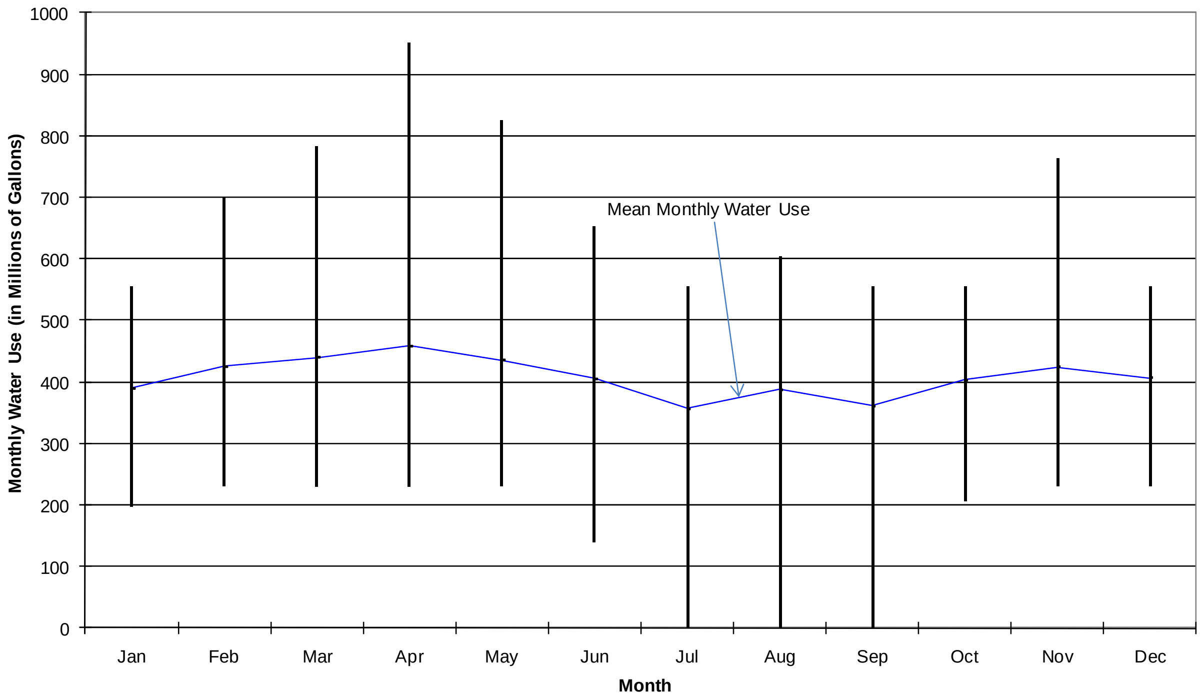


**Figure 4 - Waterloom Falls Dam Monthly Water Use, 1989 through 2008**

**Table 2 - Monthly Water Use Statistics (1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| (million gal) | 0 | 951 | 408 |
| (cfs) | 0.02 | 49.10 | 20.80 |
| (cfsm at impact point) | 0.0009 | 2.1700 | 0.9170 |
| (cfsm at Merrimack Gage) | 0.0001 | 0.2870 | 0.1210 |

## Env-Wq 2101 Requirements for Water Conservation Plan

Development and approval of a water conservation plan that meets the Water Conservation Rules (Env-Wq 2101) requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. Since Waterloom Falls Dam is hydroelectric power facility with no consumptive use, a Water Conservation Plan is not required.

## Existing Water Conservation Measures

Since Waterloom Falls Dam is managed as a run-of-river operation, no water conservation measures are used at this facility.

## Water Conservation Alternatives and Costs

Because the facility is operated on a run-of-river basis and there are no consumptive losses associated with its operations, no additional water conservation measures are currently required.

**Conservation Implementation Schedule**

Since no additional water conservation measures are currently required, there is no conservation implementation schedule.

**Water User Contact Information**

**Water User**: Kathleen R. Dolan
**Address**: PO Box 605, Hillsboro, NH 03244
**Contact**: Kathleen R. Dolan
**Phone**: 478-7828
**Email**: Not available

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

New Hampshire Dam Bureau, NHDAMS Data Sheet for Waterloom Falls Dam.

Personal communication with Robert Greenwood, Alden Hydro, LLC.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed with input from Robert Greenwood of Alden Hydro, LLC.

Water use reports on file with the Department of Environmental Services (DES).

## CONSERVATION PLAN

**Wilton Water Works (#20065)**

### Introduction

Conservation plans under the Instream Flow Program (Env-Wq 1900) require meeting the conservation measures and best management practices in the Department of Environmental Services (DES) Water Conservation Rules (Env-Wq 2101). Use of these measures and practices as a standard will provide a common level of effort by all water users.

The Wilton Water Works has two overburden water supply wells located just off Route 31 in Wilton, New Hampshire. The water pumped from these wells is the source water for the Town of Wilton.

### Water Source and Uses

The Wilton Water Works has two registered ground water wells, the Everett Well (20065-S01) and the Abbott Well (20065-S02). Figure 1 depicts the location of these wells with respect to the Souhegan Designated River. These overburden wells are located 849 feet and 97 feet west of the river. The drainage area of the Souhegan River upstream of these wells is approximately 47 sq. miles.

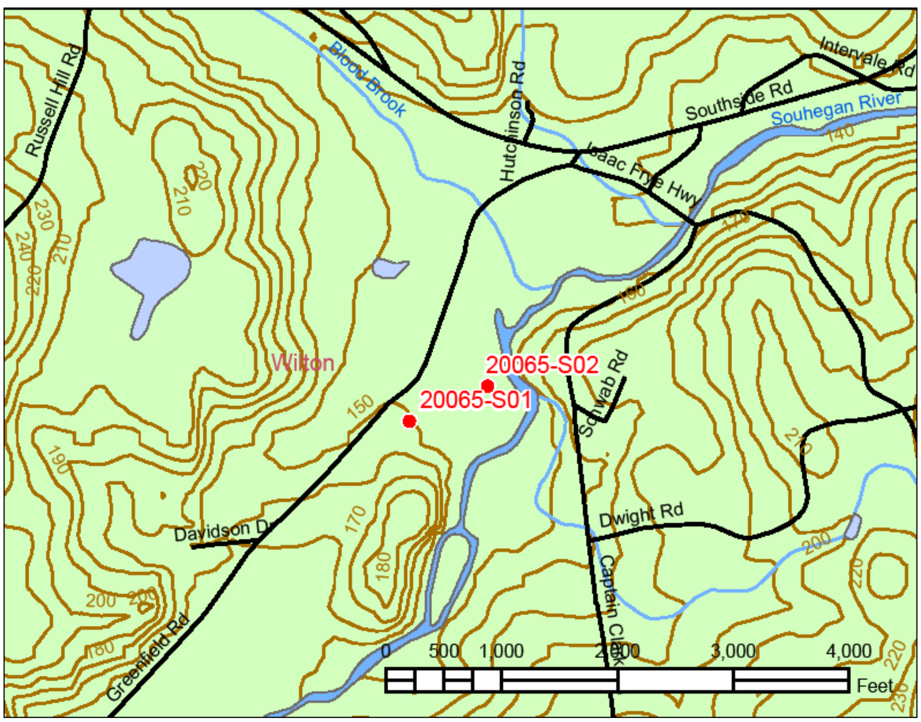


**Figure 1 – Location Map of Wilton Water Works Water Supply Wells, Wilton, New Hampshire.**

Pumping alternates between the two wells. The water produced by the wells is distributed to the Town's water supply system and can also be stored in 616,000 gallons tank.

The wells are located in a stratified drift formation connected to the Souhegan River and intercept groundwater to the Souhegan River. An analysis of the induced recharge by these wells was performed as part of the Instream Flow Study (DES 2005). The results of the analysis indicated that the wells do not induce river recharge at normal and maximum pumping levels. A more detailed hydrogeologic assessment of the production wells has since been performed by Emery & Garrett Groundwater, Inc. (2008) for the Wilton Water Commission. The objective of the study was to delineate the wellhead protection area around the Abbott and Everett Production Wells. This study included a seven day pump test of the two production wells and an evaluation of the pumping impacts on the Souhegan River. Based on the study's findings, Emery & Garrett Groundwater, Inc. (2008) concluded that "approximately 32% of the groundwater being withdrawn from the Abbott Production Well during the pumping test was induced from the Souhegan River." However, there was no evidence that the Everett Well induced recharge from the river.

**Water Use Patterns**

Water withdrawal for the Town's water supply needs is continuous and pumping alternates between the two wells to reduce drawdown in the aquifer. The active well is pumped 6 to 8 hours and then shut down for 16 to 18 hours. When system demand exceeds the preset pumping rate of the active well, the second well automatically comes on line. The pre-set flow rate for the Abbott Well is 400 gallons per minute (gpm), while the Everett Well pumping rate is pre-set at 450 gpm. Daily water demand varies diurnally with the highest demand during the day and the lowest demand at night. When pumping exceeds demand, excess water fills storage, and when pumping is less than demand, stored water makes-up the difference. Both wells are metered, and withdrawals are recorded monthly and reported to DES quarterly.

Water use data for the Wilton Water Works for the years of 1988 through 2008 are summarized in Figures 2 through 7 as well as in Tables 1 through 6, for each well and for the combined pumping of the two wells. Water use records were incomplete for 1988, so are not included in the annual use summaries. The monthly summaries include both complete and incomplete records for the years 1988 through 2008.

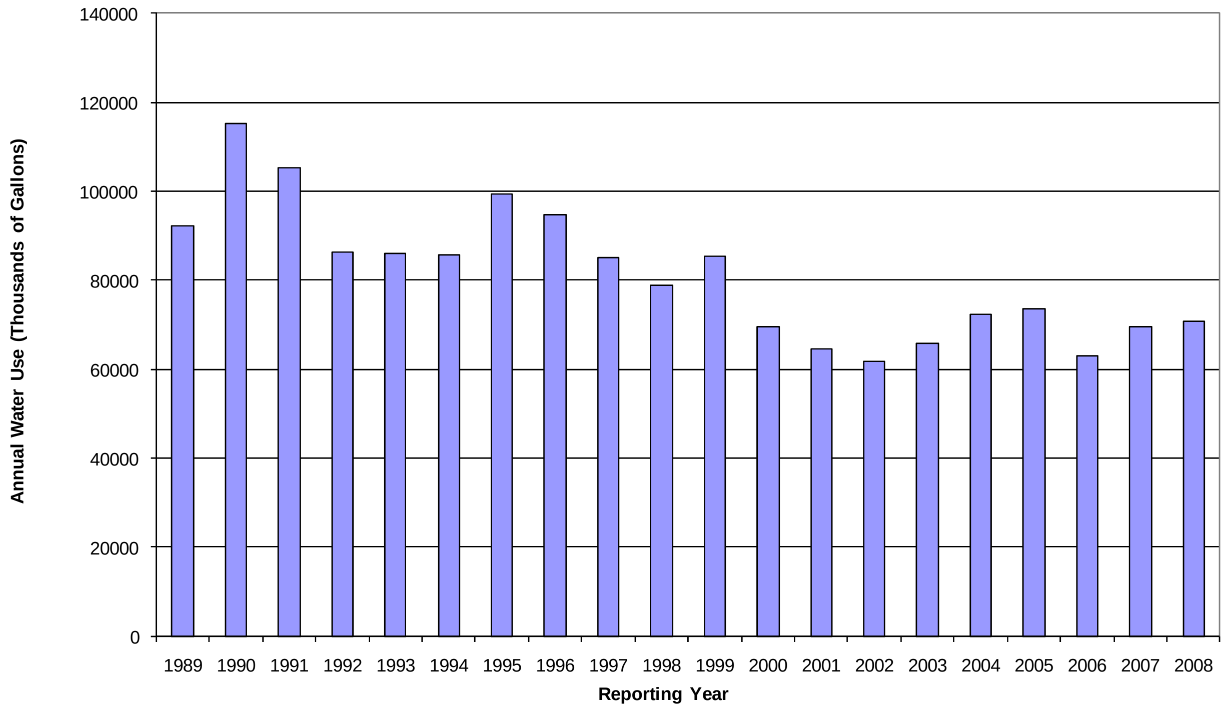


**Figure 2 - Wilton Water Works Annual Water Use, 1989-2008**

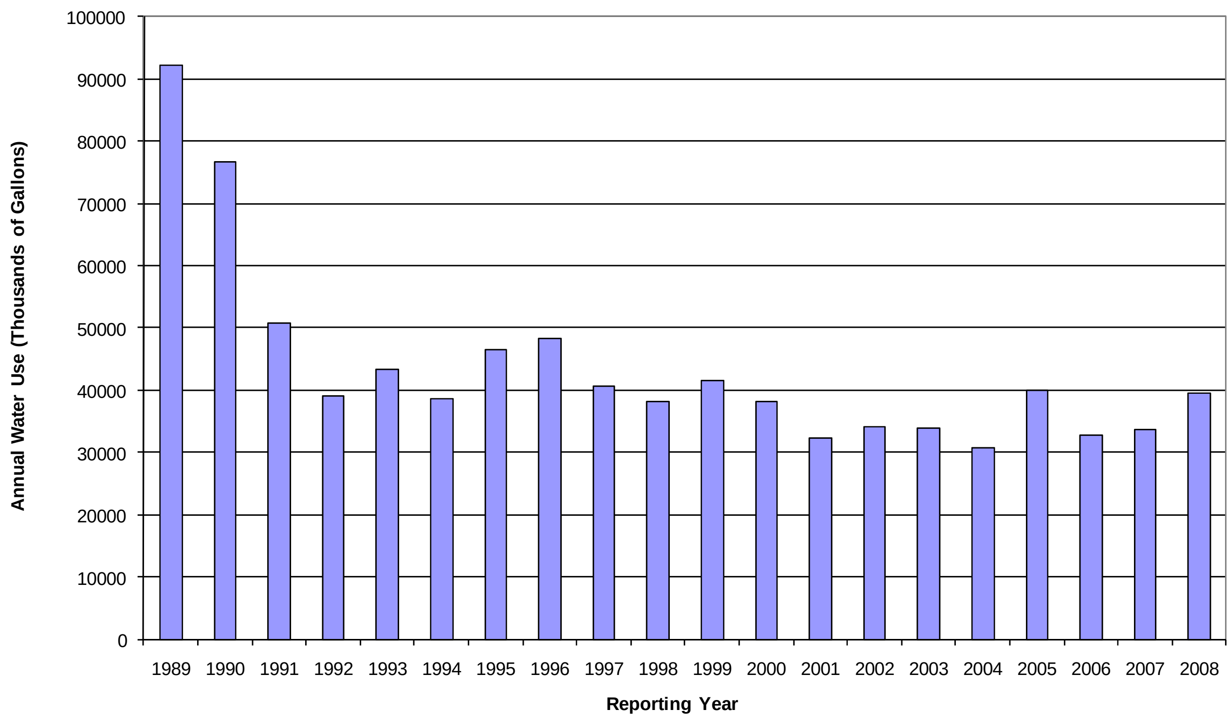


**Figure 3 - Wilton Water Works Everett Well Annual Water Use, 1989-2008**

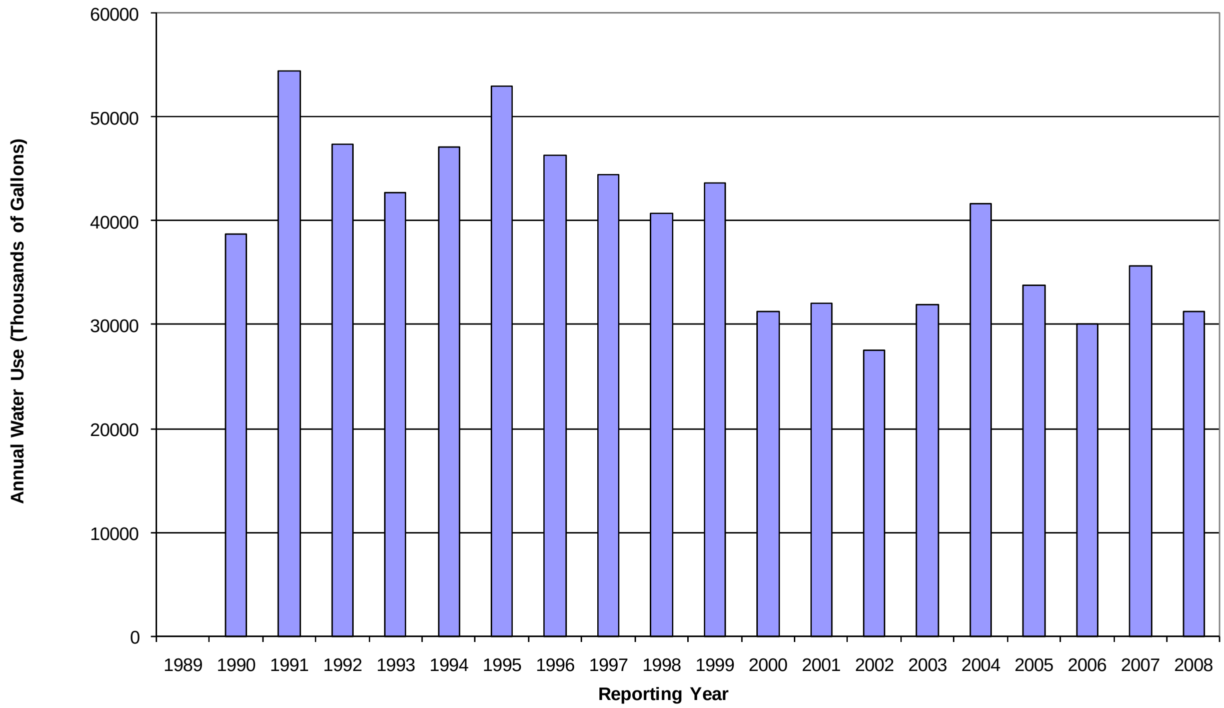


**Figure 4 - Wilton Water Works Abbott Well Annual Water Use, 1989-2008**

**Table 1 - Wilton Water Works Annual Water Use Statistics (Combined Wells 1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 61,650 | 115,200 | 81,200 |
| (cfs) | 0.0262 | 0.4889 | 0.3446 |
| (cfsm at impact point) | 0.0056 | 0.0074 | 0.0105 |
| (cfsm at Merrimack Gage) | 0.0015 | 0.0029 | 0.0020 |

**Table 2 - Wilton Water Works Annual Water Use Statistics (Everett Well 1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 30,800 | 92,200 | 43,800 |
| (cfs) | 0.1305 | 0.3913 | 0.1850 |
| (cfsm at impact point) | 0.0028 | 0.0084 | 0.0040 |
| (cfsm at Merrimack Gage) | 0.0008 | 0.0023 | 0.0011 |

**Table 3 - Wilton Water Works Annual Water Use Statistics (Abbott Well 1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 0 | 54,400 | 37,700 |
| (cfs) | 0 | 0.2318 | 0.1598 |
| (cfsm at impact point) | 0 | 0.0049 | 0.0034 |
| (cfsm at Merrimack Gage) | 0 | 0.0014 | 0.0009 |

Between 1989 and 2008, annual water use by Wilton Water Works ranged from a high of 115.2 million gallons (1990) to a low of 61.6 million gallons (2002), and average use was 81.2 million gallons (Figure 2 and Table 1). During this period, annual water use has decreased by 21.4 million gallons or 23 percent. This represents a decrease of 1.07 million gallons a year or 1.2 percent per year over the 20 year period. The decline in water use after 1995 is most likely the result of the metering of all of the water users in the Town during that year. Prior to the installation of water meters, water users only paid a flat base fee.

For the period of record, maximum, average, and minimum annual production for the Everett Well has been greater than the Abbott Well (Figures 3 and 4 and Tables 2 and 3). This difference reflects the higher pumping rate and utilization of the Everett Well. For the Abbott Well, no water use was reported in 1989, excluding that year, its minimum annual production was 27.5 million gallons in 2002.

Monthly water use records for the system begin in October 1988. Monthly water use varies in response to weather conditions and changes in seasonal demand. Total and average monthly water usage was highest during the summer and lowest during winter. This seasonal pattern reflects increased outdoor water usage (lawn irrigation, garden watering, vehicle washing, etc.) during the summer months, which declines during the fall, remains low during the winter, and begins to increase again in the spring. The highest total monthly use was 11.7 million gallons (June 1991) while the lowest monthly use was 0 in December 2008 (Tables 4, 5 and 6). Water use did occur during December 2008, but the recording meters were damaged as a result of an ice storm (Figure 5 and Table 4). Otherwise, the lowest total monthly water use was 2.1 million gallons in November 2002. The average monthly use was 6.8 million gallons (Figure 2 and Table 2).

The Everett Well (849 feet from the Souhegan River) produces more water than the Abbott Well (97 feet from the Souhegan River), except during the late summer and early fall (August through October). Monthly water use for the wells has ranged from 9.68 million gallons (Everett Well in January 1990) to 0 gallons (multiple months for both wells). The high total monthly production from the Everett Well in January (1990) was because it was the only water source for the Town at the time.

Monthly water use data for Wilton Water Works were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gage station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire, and they were also normalized to the drainage area (46.8 sq. miles) of the Designated Reach above the impact point of the withdrawals.

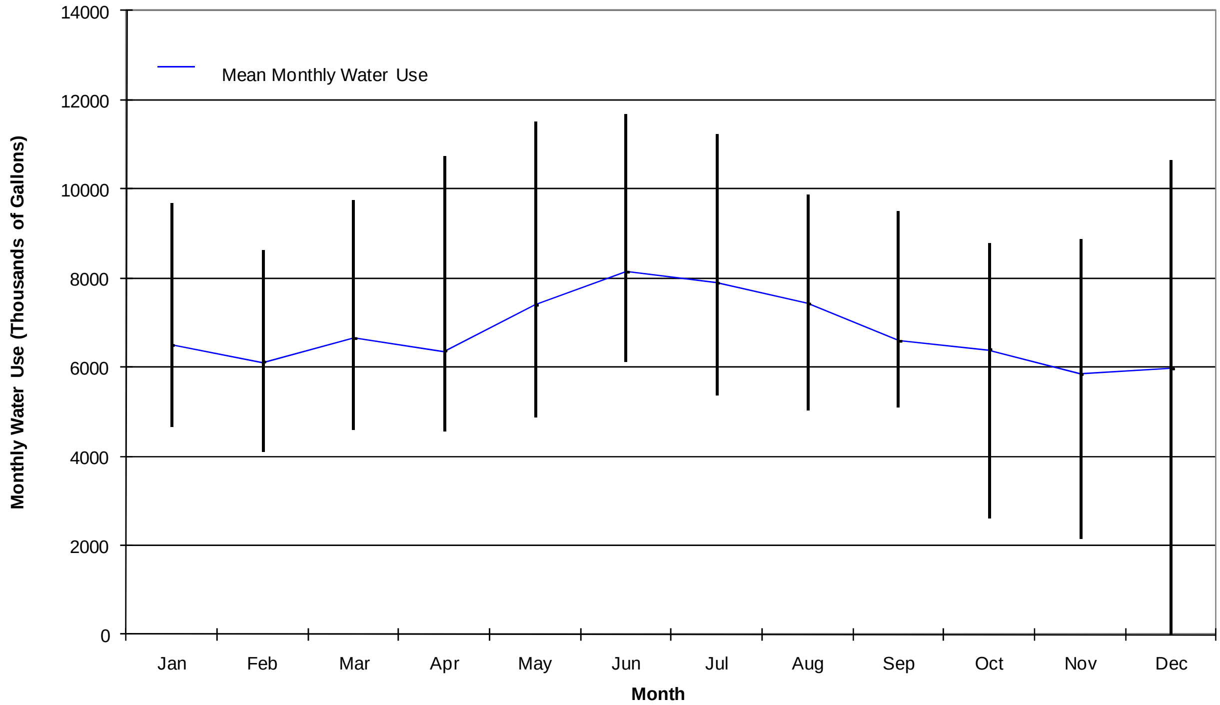


**Figure 5 - Wilton Water Works Monthly Water Use, 1988-2008**

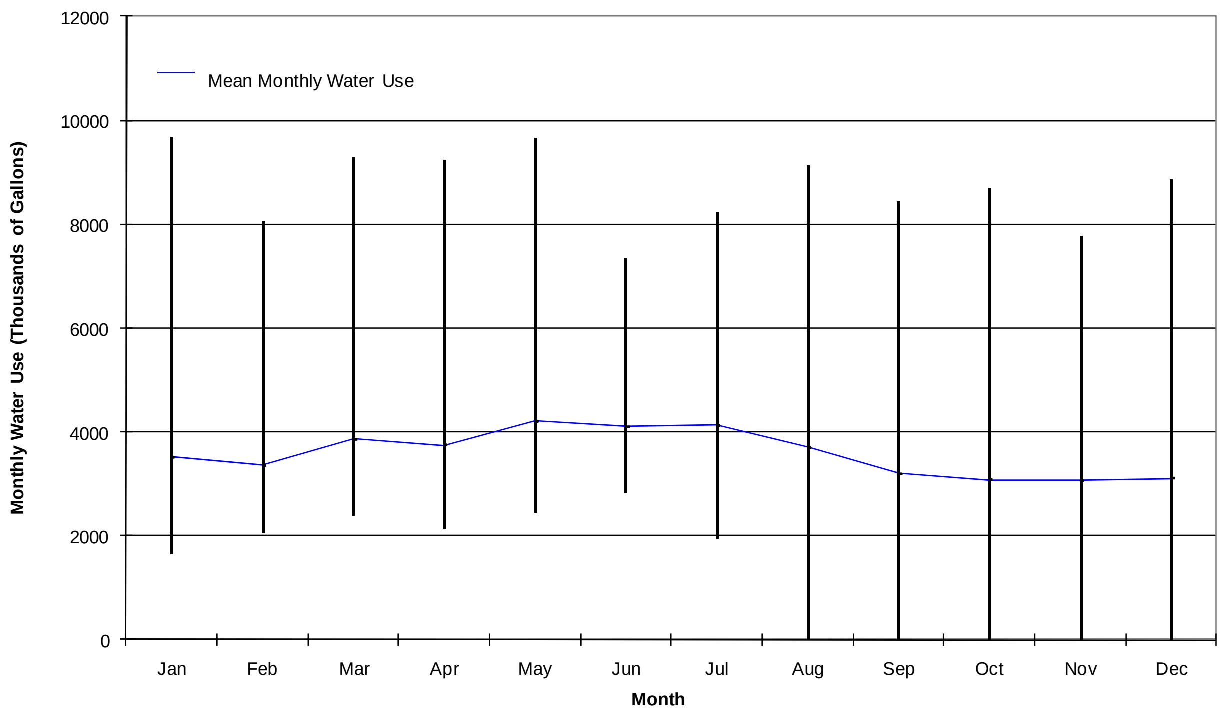


**Figure 6 - Wilton Water Works Everett Well Monthly Water Use, 1988-2008**

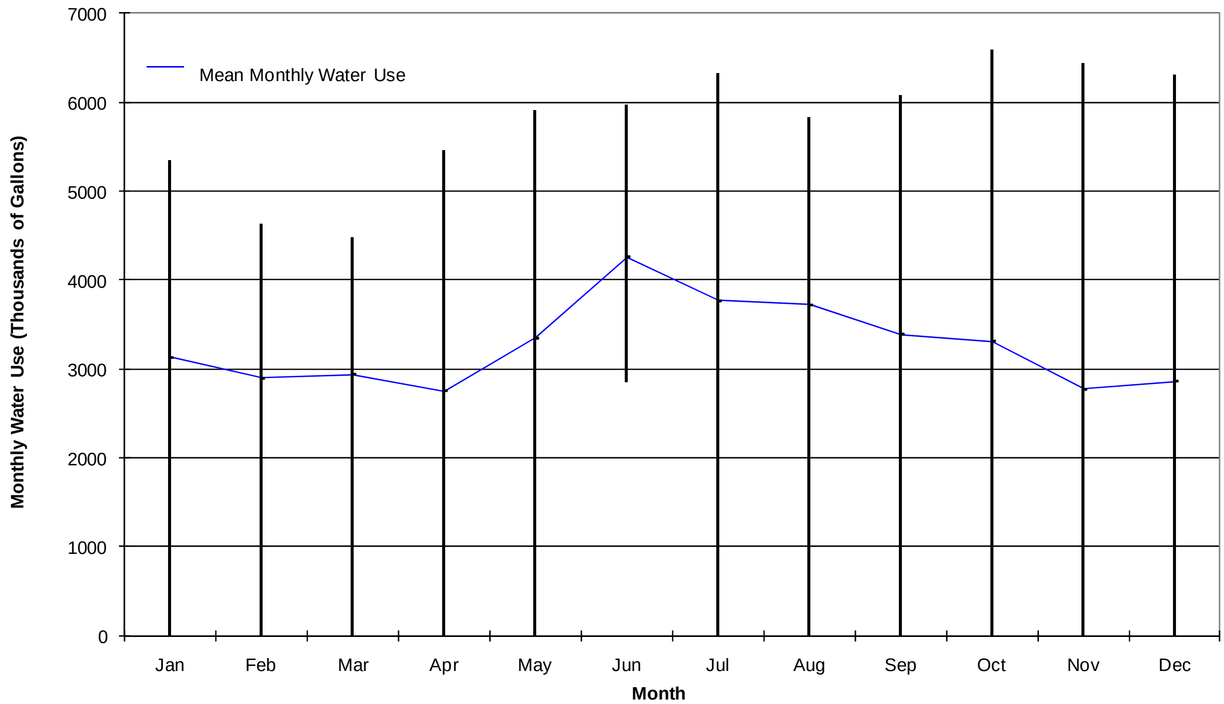


**Figure 7 - Wilton Water Works Abbott Well Monthly Water Use, 1988-2008**

**Table 4 - Wilton Water Works Monthly Water Use Statistics (Combined Wells 1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 11,700 | 6,800 |
| **(cfs)** | 0 | 0.5831 | 0.3445 |
| **(cfsm at impact point)** | 0 | 0.0125 | 0.0074 |
| **(cfsm at Merrimack Gage)** | 0 | 0.0034 | 0.0020 |

**Table 5 - Wilton Water Works Monthly Water Use Statistics (Everett Well 1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 9,680 | 3,620 |
| **(cfs)** | 0 | 0.4840 | 0.1840 |
| **(cfsm at impact point)** | 0 | 0.0103 | 0.0039 |
| **(cfsm at Merrimack Gage)** | 0 | 0.0028 | 0.0011 |

**Table 6 - Wilton Water Works Monthly Water Use Statistics (Abbott Well 1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 6,580 | 3,260 |
| **(cfs)** | 0 | 0.3300 | 0.1660 |
| **(cfsm at impact point)** | 0 | 0.0070 | 0.0035 |
| **(cfsm at Merrimack Gage)** | 0 | 0.0019 | 0.0010 |

Based on these values, the average daily water use by Wilton Water Works has ranged from a minimum of 0 cfs (0 gallons per day, December 2008) to a maximum of 0.583 cfs (376,805 gallons per day, June 1991), and average use was 0.345 cfs (222,980 gallons per day) for the period of 1988 to 2008 (Table 4).

**Env-Wq 2101 Requirements for Water Conservation Plan**

Development and approval of a water conservation plan that meets the Water Conservation Rules requirements will satisfy the Conservation Plan requirements under the Instream Flow Rules. The Conservation Rules require different activities depending on the type of water use. Conservation plans for public water supplies require inclusion of the following components:

- Installation, maintenance, and use of appropriately selected meters;
- Maintaining low levels of unaccounted-for water;
- Performing water audits to assess losses;
- A comprehensive plan for leak detection surveys of the distribution system;
- System pressure reduction, as necessary;
- A water conservation educational outreach initiative;
- Adopting a rate structure that promotes water conservation; and,
- On-going water conservation compliance reporting.

Wilton Water Works will be in compliance with the water conservation plan requirements of the Instream Flow Program by completing a Water Conservation Plan and receiving approval of it by the DES Groundwater and Drinking Water Bureau.

**Existing Water Conservation Measures**

Several water conservation measures have been implemented by the Wilton Water Works. The source wells are metered and the water meters at the wells are tested and calibrated, if needed, approximately every two years. Every customer of the Wilton Water Works has been metered since 1995 and the service meters are inspected when problems are suspected. Leak detection is performed on a case-by-case basis, although the Town is investigating funding for developing and implementing a leak detection program.

Water bills are issued on a semi-annual basis, with a base fee per water user for the period plus a flat fee per 1,000 gallons. Information on water conservation and efficiency is posted on the Wilton Water Commission's web site.

**Water Conservation Alternatives and Costs**

The existing water conservation measures employed by Wilton Water Works should be expanded to include measures to better identify water losses and to increase water use efficiency. As required under the Water Conservation Rules for existing large community water systems (Env-Wq 2101.05), the Town will determine its unaccounted-for water use annually. If the amount of unaccounted-for water use exceeds 15 percent, a response plan will be submitted to the DES within 60 days. The response plan will identify how the water system will reduce the percentage of unaccounted for water below 15 percent within two years. In addition, a regularly scheduled leak detection program for the system should be developed and implemented to identify water losses. It is also recommended that Wilton Water Works formally adopt a formal water conservation policy for the Town, using the water conservation measures outlined in the Emergency Plan Guide (Wilton Water Works 2009).

If the Town needs to implement or maintain more restrictive water conservation measures due to diminished supply from its source(s) or storage, then those actions take precedence over this Conservation Plan. Nothing in this Plan precludes the Town from further conservation actions on its own initiative.

**Conservation Implementation Schedule**

By June 1, 2014, Wilton Water Works will finalize a Water Conservation Plan in accordance with Env-Wq 2101 in order to meet the Instream Flow Rule (Env-Wq 1900) requirements for a conservation plan. The Water Conservation Plan will document the Wilton Water Work's existing water conservation activities as well as compliance with the requirements for Existing Large Community Water Systems (Env-Wq 2101.05). The Plan will be administered by the Drinking Water and Groundwater Bureau under the authority of the Instream Flow Program.

**Water User Contact Information**

**Water User**: Wilton Water Works
**Address**: P.O. Box 83, 42 Main Street, Wilton, NH, 03086
**Contac**t: Charles McGettigan, Jr., Water Commissioner
**Phone**: 654-6602
**Email**: Not available

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Env-Wq 2101 Water Conservation Rules, adopted 5/12/05.

Env-Wq 2102 Water Use Registration and Reporting Rules, adopted 5/12/05.

Department of Environmental Services (DES) 1998. Developing a Water Utility Conservation Program. Environmental Fact Sheet WD-WSEB-6-1.

Department of Environmental Services (DES) 2001. Implementing a Water Efficiency and Conservation Program for Public Water Utilities. Environmental Fact Sheet WD-WSEB-26-9.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Emery & Garrett Groundwater, Inc. 2008. Delineation of the Wellhead Protection Area around the Abbott and Everett Production Wells, Wilton, New Hampshire. Prepared for the Wilton Water Commission.

Personal communication with Charles McGettigan, Jr. Wilton Water Commission.

Personal communication with Jim Tuttle, Wilton Water Commission.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. completed by Charles McGettigan, Jr. of the Wilton Water Commission.

Wilton Water Works 2009. Emergency Plan Guide. Effective March 2009, Updated July 2009.

Water use reports on file with the Department of Environmental Services (DES).

# Appendix B

# Water Use Plans

## Souhegan River Water Management Plan

## August 2013

## WATER USE PLAN

### Amherst Country Club (#20190)
### Ponemah Green Family Golf Center (#20624)

**Introduction**

The following Water Use Plan (WUP) has been prepared for Amherst Country Club and Ponemah Green Family Golf Center in Amherst, New Hampshire. This WUP was prepared using information provided by Amherst Country Club and Ponemah Green Family Golf Center (Ponemah Green) and from their water use records reported to the Department of Environmental Services (DES). These facilities are located along the Souhegan Designated River and use water withdrawn from the river to irrigate their respective golf courses. Since both golf courses and with respective irrigation systems are operated by Amherst Country Club, this WUP applies to the combined facilities.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Amherst Country Club/Ponemah Green is considered an Affected Water User (AWU) because their shared registered water source is within 500 ft of the Souhegan Designated River and their registered water source is within the Souhegan River Water Management Planning Area, which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

**Water Source and Uses**

The Amherst Country Club/Ponemah Green withdraws water from the Souhegan Designated River using two 7.5 hp sump pumps, resting 8-10 inches off the bottom of the river. Water is withdrawn on an “as needed” basis to irrigate 105 acres of golf course fairways, greens and tees. The purpose of irrigating the courses is to ensure that the various grasses used at the courses remain healthy, adequately watered and meet user expectations.

**Water Use Patterns**

Water use is metered, recorded monthly and reported to DES annually. As noted, water is used on an as-needed basis, with the greatest use during the spring through the fall, depending on the weather. Weather conditions are monitored using information from local weather stations available via the internet. Irrigation is typically performed on a daily basis from early evening to early morning (10-12 hours), when necessary. This irrigation schedule can change depending on the results of the soil moisture monitoring performed on the course and in response to any mechanical failures of the irrigation system.

Water use data for Amherst Country Club and Ponemah Green for the years of 1989 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 and in Tables 1 and 2. The tables include the conversion of the water use from thousands of gallons to cubic feet per second (cfs) and cubic feet per second per square mile of the drainage area to allow for their comparison with streamflow values reported for the Souhegan Designated River.

Between 1989 and 2008, annual water use by Amherst County Club and Ponemah Green ranged from a high of 34.4 million gallons (1999) to a low of 8.52 million gallons (1989), and average use was 24.3 million gallons (Figure 1 and Table 1). During this period, annual water use increased by 6.86 million gallons or 81 percent. This represents an increase of 343,000 gallons a year or 4.1 percent per year.

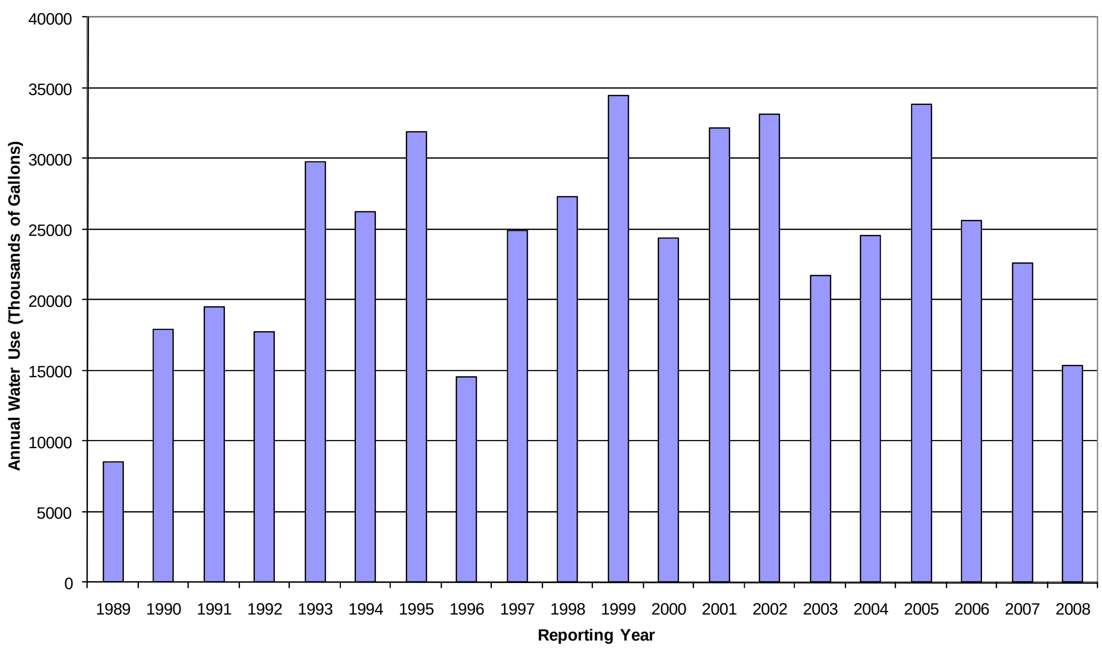


**Figure 1 - Amherst Country Club and Ponemah Green Family Golf Center Annual Water Use from 1989 through 2008**

**Table 1 – Amherst Country Club and Ponemah Green Family Golf Center Annual Water Use Statistics (1989 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| (1,000 gal) | 8,520 | 34,400 | 24,300 |
| (cfs) | 0.0360 | 0.1460 | 0.1030 |
| (cfsm at impact point) | 0.0003 | 0.0010 | 0.0007 |
| (cfsm at Merrimack Gage) | 0.0002 | 0.0009 | 0.0006 |

Water withdrawals begin in April, increase to a maximum in July and then decline and end by November (Figure 2). The range in monthly water use reflects the weather conditions that affect the water demand by the golf course turf. The highest total monthly water use was 17.1 million gallons (July 2002, a time of drought), the lowest total monthly water use was 0 (multiple occurrences), with an average monthly use of 2.01 million gallons over a full year (Table 2). When averaged for only the April-October period, average monthly water use was 3.47 million gallons.

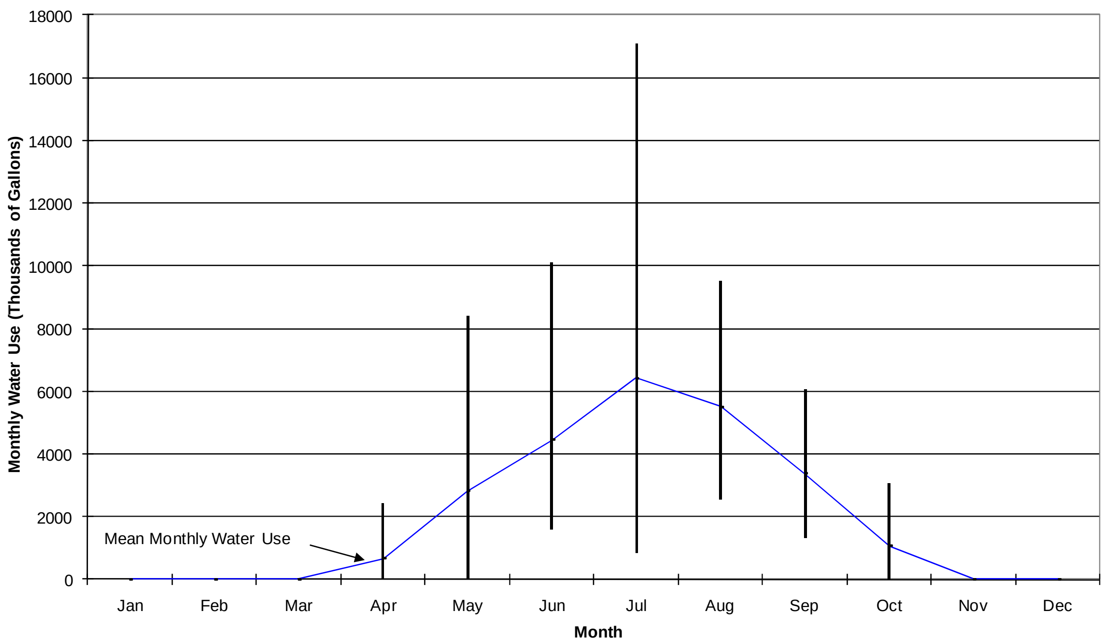


**Figure 2 - Amherst Country Club and Ponemah Green Family Golf Center Monthly Water Use from 1989 through 2008**

**Table 2 – Amherst Country Club and Ponemah Green Family Golf Center Monthly Water Use Statistics (1989 through 2008)**

| | Low | High | Average | Apr - Oct avg |
|---|---|---|---|---|
| (1,000 gal) | 0 | 17,100 | 2,010 | 3,470 |
| (cfs) | 0 | 0.8540 | 0.1020 | 0.1760 |
| (cfsm at impact point) | 0 | 0.0060 | 0.0007 | 0.0012 |
| (cfsm at Merrimack Gage) | 0 | 0.0050 | 0.0006 | 0.0010 |

The monthly water use data were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (142 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the water use of the Amherst Country Club and Ponemah Green has ranged from a minimum of 0 cfs (several months), to a maximum of 0.854 cfs (551,957 gallons per day, July 2002) with an average of 0.176 cfs (113,752 gallons per day) for the April through October period and 0.102 cfs (65,925 gallons per day) annually during the last 20 years (Table 2).

**Potential for Water Use Management to Support Protected Instream Flows**

Presently, the Amherst Golf Course and Ponemah Green are solely dependent upon the direct withdrawal of water from the Souhegan Designated River as their source of irrigation water and, as a result, have limited potential to manage its water use to support the protected instream flows. During those infrequent periods when a reduction in water withdrawals is needed to support the protected instream flows, alternative off-stream sources of water may be needed. These may include:

- withdrawals from existing ponds on the golf course;
- the development of additional water hazard/storage ponds; and
- the development of a new groundwater supply

There are a total of six small ponds located within the Amherst Country Club and Ponemah Green properties. In the past, water was withdrawn from the ponds located on the Ponemah Green property and used for irrigation. This practice was discontinued with the construction of the withdrawal from the Souhegan Designated River, which represents a more reliable source of water. During periods when streamflow in the river falls below the Critical or Rare flow thresholds for a period greater than their catastrophic durations, Amherst Country Club and Ponemah Green could use the former pond withdrawal to temporarily reduce its direct withdrawal from the river.

The construction of additional water hazards or storage ponds on the Amherst Country Club and Ponemah Green properties would potentially impact existing golf course operations due to the lack of undeveloped land. Expansion of the existing ponds is possible, but would reduce the buffer area around these features and potentially impact existing operations.

Another potential alternative off-stream water supply source would be the development of a new groundwater supply. Based on information available from the United States Geological Survey (Toppin 1987), the Amherst Country Club and Ponemah Green properties are located on a stratified-drift aquifer. Production from a new well could be used during periods when streamflow in the river falls below the Critical or Rare flow thresholds for a period greater than their catastrophic durations, thereby replacing or reducing its direct withdrawal from the river.

Each of these alternatives would require additional evaluation to determine their feasibility. Important factors in determining their feasibility would include: the amount of water made available by the development of the alternative; the identification and evaluation of any hydrologic impact to the Souhegan Designated River as a result of the development of the alternative; and the cost of each alternative and their permitting requirements.

**Water Use Plan Activity**

The highest mean and total monthly water use by Amherst Country Club and Ponemah Green occurs during June, July and August, which also coincides with the two bioperiods (GRAF Spawning and Rearing & Growth – June 15 to September 30) that have the lowest protected instream flow values (Critical flow of 26 cfs and Rare flow of 17 cfs, DES 2008). To support the protected instream flows, Amherst Country Club and Ponemah Green will be required to reduce its direct withdrawal of water from the Souhegan Designated River to the *de minimis* amount when mean daily discharge, as measured at the USGS gaging station (01094000) in Merrimack, falls below the Critical flow threshold of 26 cfs for a period exceeding its catastrophic duration of 20 days or when the mean daily discharge falls below the Rare flow threshold of 17 cfs. Mean daily discharge at the USGS gaging station and the protected instream flow conditions will be tracked by DES and will be available at its web page:

http://www2.des.state.nh.us/OneStopPub/Watershed/souhegan-lower-pisf-track.xls

Under Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, the *de minimis* amount of water "shall always be available for use," where the *de minimis* amount is defined as being "equal to 5 percent of 7Q10 at that location" (Env-Wq 1902.07). 7Q10 refers to the lowest average flow rate for a period of 7 consecutive days on an annual basis with an expected recurrence interval of once in every 10 years (Env-Wq 1902.01). Based on the discharge records for the USGS gaging station (01094000) in Merrimack, the 7Q10 for the Souhegan Designated River is 12.9 cfs, so the *de minimis* amount (5 percent) is equal to 0.65 cfs or 416,876 gallons per day. This *de minimis* amount of water is to be shared equally among those withdrawing water under this condition; the Amherst Country Club/Ponemah Green Family Golf Center, Souhegan Woods Golf Club, and Mr. de Bruyn Kops.

Since there are two other direct withdrawals on the Souhegan Designated River, the portion available to the Amherst Country Club and Ponemah Green facility is 0.22 cfs or 142,190 gallons per day. While this value is slightly higher than the historical average water use (in cfs) by Amherst Country Club and Ponemah Green Family Golf Center from April through October (Table 2) it is less than the average water use during the months of June, July and August. This suggests that more stringent water conservation measures would need to be implemented as a management action by Amherst Country Club and Ponemah Green Family Golf Center to reduce water demand, or that an alternative source(s) of water would need to be used to supplement the water withdrawal from the river.

The reduction in the direct withdrawal of water from the Souhegan Designated River would be rescinded when daily mean discharge, as measured at the USGS gaging station (01094000), exceeds 26 cfs, from a natural recharge event, for two consecutive days.

**Estimated Water Use Plan Implementation Costs**

During periods of reduced withdrawals from the Souhegan Designated River, Amherst Country Club and Ponemah Green Family Golf Centers would need to either reduce their irrigation operations by taking additional conservation measures or supplement the withdrawal of water from existing or new on-site storage ponds or from a new groundwater supply well. The development of a new groundwater supply well has several potential advantages over on-site storage ponds, the most important being that it would provide a larger and more continuous source of water for irrigation. The estimated cost for the exploration, permitting and development of a new well is dependent on the site specific conditions, but this cost could exceed $100,000.

**Water Use Plan Implementation Schedule**

By June 1, 2014, Amherst Country Club and Ponemah Green will implement its Water Use Plan and will institute the measures required to support the protected instream flows on the Souhegan Designated River during the GRAF Spawning and Rearing & Growth bioperiods from June 15 to September 30.

**Water User Contact Information**

**Water User:** Amherst Golf Club/Ponemah Green Family Golf Center
**Address:** 72 Ponemah Rd, Amherst, 03031
**Contact:** Steve Wilson, Golf Course Superintendent
**Phone:** 673-9908 ext. 20
**Email:** SWilson@AmherstCountryClub.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Steve Wilson, Amherst Country Club and Ponemah Green Family Golf Center.

Toppin, K.W. 1987. Hydrogeology of Stratified-Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area. South-Central New Hampshire. United States Geological Survey Water-Resources Investigations Report 86-4358. Prepared in cooperation with the Nashua Regional Planning Commission and the New Hampshire Water Resources Board.

Personal communication with Jamin Warren, Amherst Country Club and Ponemah Green Family Golf Center.

Personal communication with Steve Wilson, Amherst County Club.

Water use reports on file with the Department of Environmental Services (DES).

## WATER USE PLAN

## Chamberlain Falls Dam (#20230)

### Introduction

The following individual Water Use Plan (WUP) has been prepared for Chamberlain Falls Dam, which is located on the Souhegan River in Greenville, New Hampshire. This WUP was prepared using information provided by Alden Engineering and from their water use records reported to the Department of Environmental Services (DES). The dam is a privately owned hydropower facility that is licensed by the Federal Energy Regulatory Commission (FERC Project No. 7922) and registered with the DES Dam Bureau (#101.03).

Under the Instream Flow Rules (Chapter Env-Wq 1900), Chamberlain Falls Dam is considered an Affected Water User (AWU) because it is a registered water source within 500 ft of the designated segment of the Souhegan River. In addition, the dam is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

### Water Source and Uses

The source of water for the hydropower operations at Chamberlain Falls Dam is the main stem of the Souhegan River and the small impoundment immediately upstream of the dam. The dam is operated as run-of-river, meaning that the operation of the dam does not alter the flow of the river, and that all of the water diverted through the hydroelectric turbines is returned to the river.

If sufficient flow is available, the hydroelectric operations at Chamberlain Falls Dam can produce power 24 hours a day, seven days a week, 365 days a year. Under the terms of its license to operate, the facility must allow for a minimum outflow of 10 cubic feet per second (cfs) during the summer (June through September) and 15 cfs during the winter (October through May). When the hydropower facility is not operating (flows less than 20 cfs), all of the flow goes over the spillway of the dam.

### Water Use Patterns

Water use data for the Chamberlain Falls Dam, for the period of 1989 through 2008, were obtained from the DES and are summarized in Figures 1 and 2 and in Tables 1 and 2. Water use records for 1989 and 1990 were incomplete, and water use data for 1997, 1999 and 2007 were missing, so they are not included in the annual use summaries.

Water use by Chamberlain Falls Dam is dependent on river flow. Between 1991 and 2008, annual water use by Chamberlain Falls Dam ranged from a high of 7,470 million gallons (2003) to a low of 2,100 million gallons (2001), and average use was 4,680 million gallons for the 15 years that a complete record was available (Figure 1 and Table 1). Annual water use has not shown significant upward or downward trends and has mirrored the water usage at other Souhegan River dams.

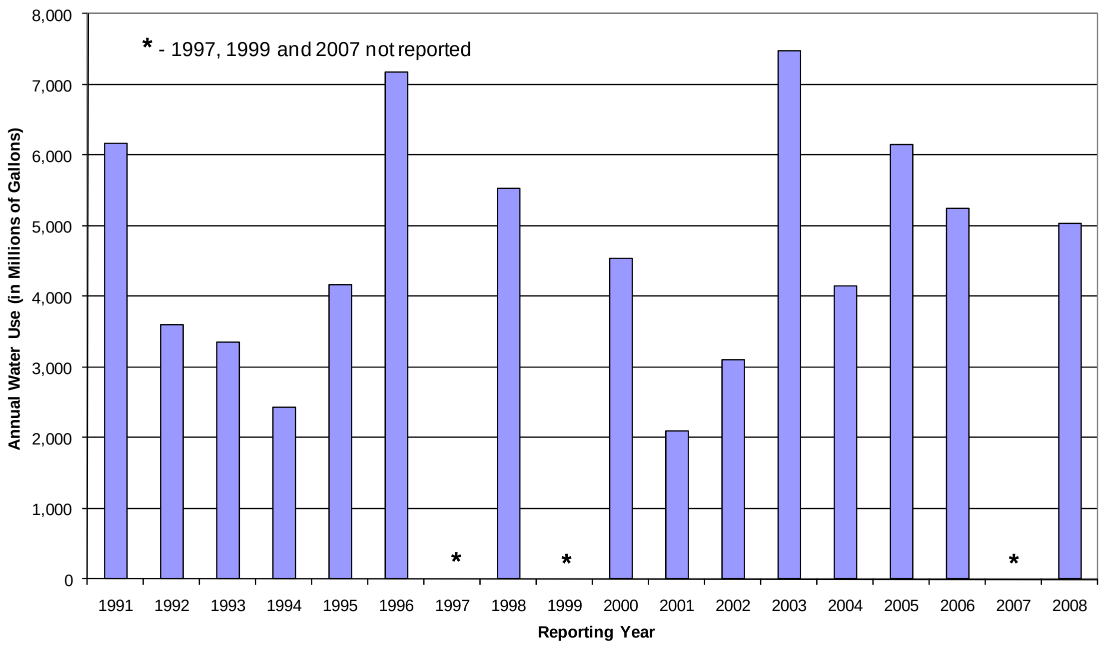


**Figure 1 – Chamberlain Falls Dam Annual Water Use 1991 through 2008**

**Table 1 – Chamberlain Falls Dam Annual Water Use Statistics (1991 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 2,100 | 7,470 | 4,680 |
| **(cfs)** | 8.93 | 31.70 | 19.90 |
| **(cfsm at impact point)** | 0.301 | 1.070 | 0.670 |
| **(cfsm at Merrimack Gage)** | 0.052 | 0.190 | 0.116 |

The highest total monthly water use by Chamberlain Falls Dam was 1,170 million gallons (April, 2008), the lowest total monthly water use was 0 gallons (June 2008), with an average monthly use of 393 million gallons (Figure 2 and Table 2). Generally, monthly water use is quite consistent, varying between 350 and 500 million gallons per month. Greatest monthly usage is usually during April, when river flows are highest, which is typical for a run-of-river dam in New Hampshire.

The monthly water use data were converted from thousand gallons per month to cubic feet per second (cfs) by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (29.6 sq. miles) of the Designated Reach above the impact point of the withdrawal.

Based on these values, the average daily water use for Chamberlain Falls Dam has ranged from a minimum of 0 cfs (June 2008) to a maximum of 60.2 cfs (38.9 million gallons per day, April 2008), and average use was 20.0 cfs (12.9 million gallons per day) for the period of 1988 to 2008 (Table 2).

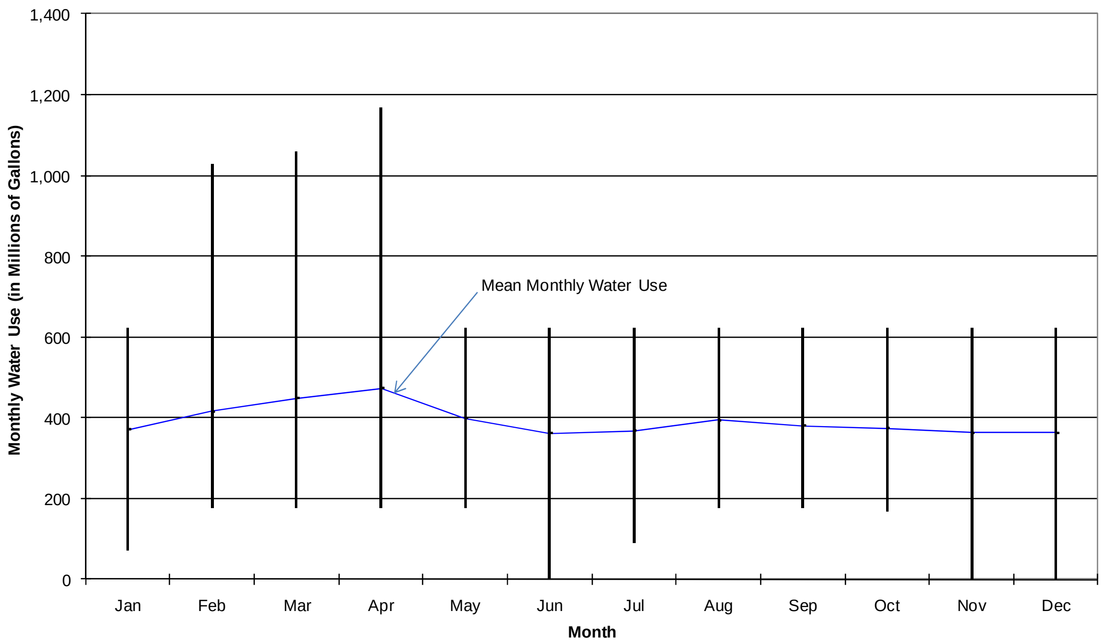


**Figure 2 – Chamberlain Falls Dam Monthly Water Use 1991 through 2008**

**Table 2 – Chamberlain Falls Dam Monthly Water Use Statistics (1989 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 0 | 1,170 | 393 |
| **(cfs)** | 0 | 60.20 | 20.00 |
| **(cfsm at impact point)** | 0 | 2.030 | 0.676 |
| **(cfsm at Merrimack Gage)** | 0 | 0.352 | 0.117 |

## Potential for Water Use Management to Support Protected Instream Flows

Chamberlain Falls Dam has limited potential to manage its water use to support the Protected Instream Flows because it is operated on a run-of-river basis and is already required to support minimum flows in the Souhegan Designated River as a condition of its FERC operating license. The water use of the dam reflects the discharge of the river.

**Water Use Plan Activity**

Since Chamberlain Falls Dam is operated on a run-of-river basis, and is required to maintain minimum flows in the Souhegan Designated River, the only water use management action to be taken to support the protected instream flows is to pass relief flows un-attenuated from the dams located upstream during a water management action event.

**Estimated Water Use Plan Implementation Costs**

Since the water use management action for Chamberlain Falls Dam is to allow any relief flows to pass un-attenuated, there is no direct cost associated with the implementation of the plan.

**Water Use Plan Implementation Schedule**

By June 1, 2014 Chamberlain Falls Dam will implement its Water Use Plan in order to institute the measures required to support the protected instream flows.

**Water User Contact Information**

**Water User**: Alden Hydro LLC
**Address**: 69 Spring Hill Road, Sharon, NH 03458
**Contact**: Robert Greenwood
**Phone**: 924-5777
**Email**: greenwoodandson@aol.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) Dam Bureau, NHDAMS Data Sheet for Chamberlain Falls Dam.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed with input from Robert Greenwood, Alden Engineering.

Water use reports on file with the Department of Environmental Services (DES).

# WATER USE PLAN

## Greenville Water Works (#20047)

### Introduction

The following individual Water Use Plan (WUP) has been prepared for Greenville Water Works, which serves as the public water supplier for the Town of Greenville, New Hampshire and provides industrial process water to Pilgrim Foods (#20681). Greenville Water Works has one active water source, the Tobey Reservoir located in Temple, New Hampshire. This WUP was prepared using information provided by Greenville Water Works and from their water use records reported to the Department of Environmental Services (DES).

Under the Instream Flow Rules (Chapter Env-Wq 1900), Greenville Water Works is considered an Affected Water User (AWU) because its registered water source is within 500 ft of a tributary to the Souhegan Designated River and its registered water source is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

### Water Source and Uses

The Town of Greenville's water supply source is the Tobey Reservoir (20047-S01), which is located in Temple, New Hampshire east of Route 45. The Tobey Reservoir was created by two dams; one on an unnamed tributary of Temple Brook to the north and the other on an unnamed tributary of the Souhegan River to the south. Temple Brook flows into Blood Brook in Wilton, which discharges into the Souhegan River approximately 4 miles downstream of Greenville. A small drain pipe is located at the base of the north dam and water is not continuously released from this outlet structure. Water is continuously released to a small stream through an outlet structure at the south dam. This unnamed tributary then flows to the south and discharges into the Souhegan River approximately 1.3 miles downstream of Greenville. The major source of water for the reservoir is the two contributing watershed of the small unnamed tributaries.

Water withdrawn from the reservoir is pumped to a water treatment plant. The water treatment facility is capable of treating 0.25 million gallons of drinking water per day. Greenville recently completed a new 600,000 gallon storage tank, which brings their treated water storage capacity to 750,000 gallons. The treated water is distributed to residents and businesses located within the town.

## Water Use Patterns

Water use data for the Greenville Water Works for the period of 1999 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 and as well as Tables 1 and 2. The water use records for the system were incomplete for 1999, so they are not included in the annual use summaries. The monthly summaries include both complete and incomplete records for the years 1999 through 2008.

Between 2000 and 2008, annual water use by Greenville Water Works ranged from a high of 67.4 million gallons (2001) to a low of 41.4 million gallons (2004) with an average annual use of 54.0 million gallons (Figure 1 and Table 1). During this period, annual water use declined by 19.86 million gallons or 30 percent. This represents an average decrease of 2.21 million gallons per year or 3.4 percent per year over this nine year period. The lack of any growth in water use is attributable to no significant new development in the town and also reflects the improvements made to the water distribution system to reduce leakage.

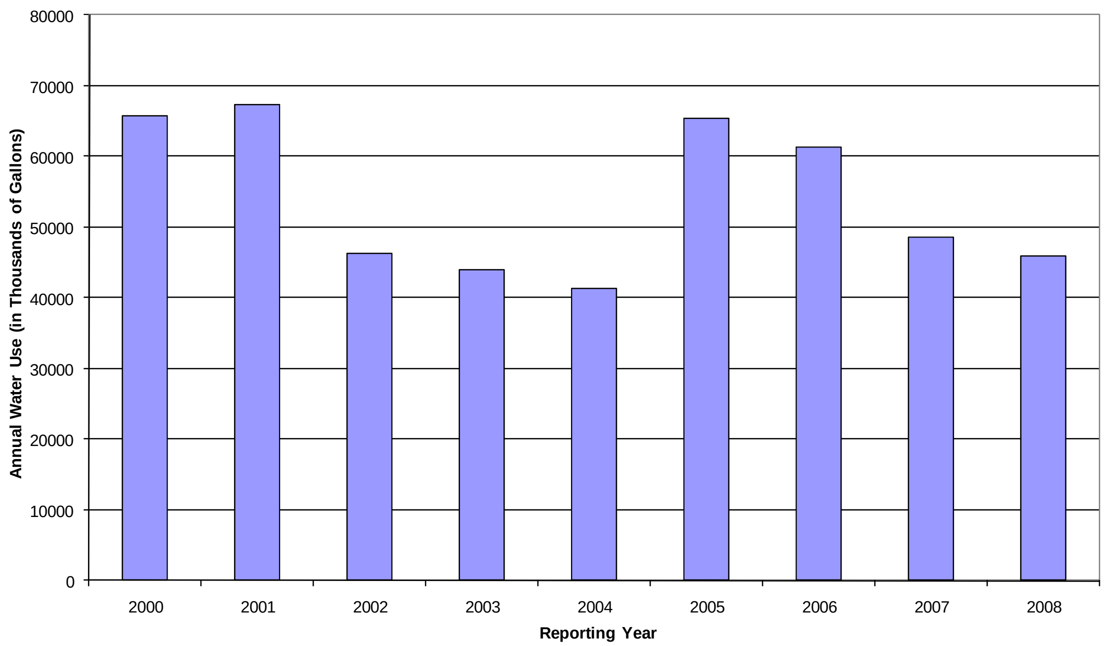


**Figure 1 – Town of Greenville Water Works Annual Water Use from 2000 through 2008**

**Table 1 – Town of Greenville Water Works Annual Water Use Statistics (2000 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 41,400 | 67,400 | 54,000 |
| (cfs) | 0.1760 | 0.2860 | 0.2290 |
| (cfsm at impact point) | 0.0045 | 0.0074 | 0.0059 |
| (cfsm at Merrimack Gage) | 0.0010 | 0.0017 | 0.0013 |

The monthly water use records for the system begin in March 1999. Monthly water use varies in response to weather conditions and changes in seasonal demand. The total and average monthly water usage was highest during summer and lowest during winter (Figure 2). This seasonal pattern reflects increased outdoor water usage (lawn irrigation, garden watering, vehicle washing, etc.) during the summer months, which is a minimum during the winter months. The highest total monthly water use was 7.54 million gallons (April, 2005), the lowest total monthly water use was 1.92 million gallons (May and June, 2004), while the average monthly water use was 4.56 million gallons (Figure 2 and Table 2).

Approximately 12.0 million gallons of annual water use is by Pilgrim Foods (#20681), an industrial facility in the Town of Greenville. Pilgrim Foods' monthly water use varies in the range of 1.10 to 1.70 million gallons during the year.

The monthly water use data for Greenville Water Works were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (38.8 sq. miles) of the Designated Reach above the impact point of the withdrawal.

Based on these values, the average daily water use by Greenville Water Works has ranged from a minimum of 0.099 cfs (63,986 gallons per day, June 2004) to a maximum of 0.389 cfs (251,419 gallons per day)(April 2005), and average use was 0.232 cfs (149,946 gallons per day) for the period of 1999 to 2008 (Table 2).

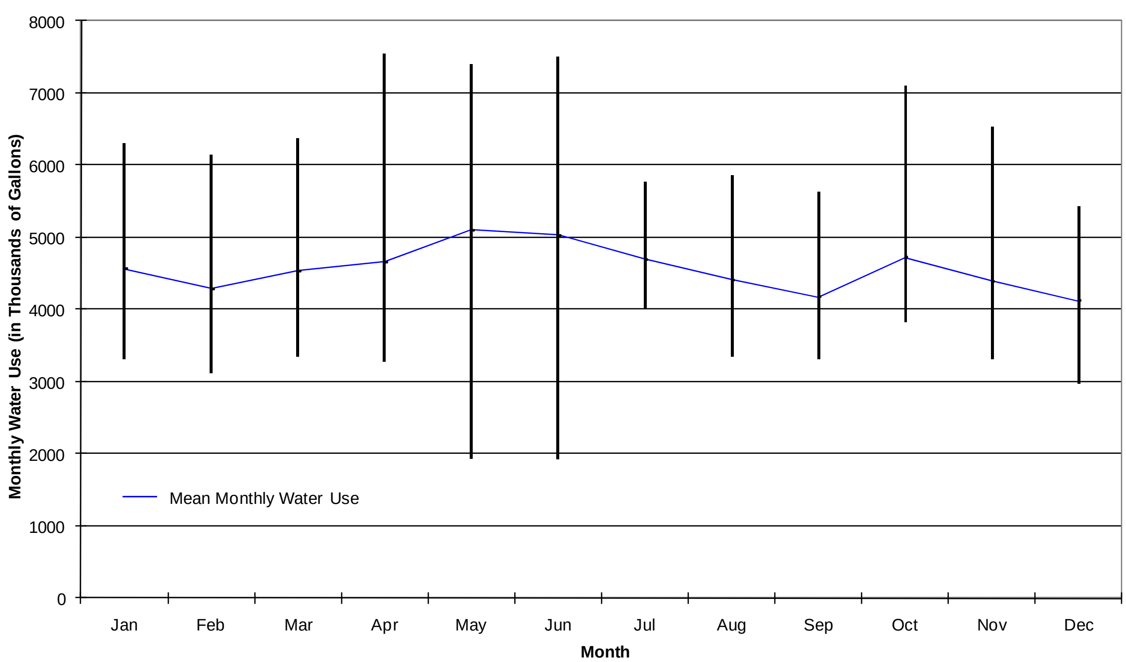


**Figure 2 – Town of Greenville Water Works Monthly Water Use from 1999 through 2008**

**Table 2 – Town of Greenville Water Works Monthly Water Use Statistics (1999 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 1,920 | 7,540 | 4,560 |
| (cfs) | 0.0990 | 0.3890 | 0.2320 |
| (cfsm at impact point) | 0.0026 | 0.0100 | 0.0060 |
| (cfsm at Merrimack Gage) | 0.0006 | 0.0023 | 0.0014 |

**Potential for Water Use Management to Support Protected Instream Flows**

The potential for the management of water use by Greenville Water Works to support the protected instream flows on the Souhegan Designated River is moderate to low. Greenville's existing water supply, the Tobey Reservoir, is located in the headwaters of a tributary of Souhegan Designated River. The dam reportedly (DES Dam Bureau) has a maximum storage volume of 3,310 acre-feet (1,078 million gallons) with 652 acre-feet (212.5 million gallons) of storage reserved for water supply.

**Water Use Plan Activity**

Greenville's water use could be managed to support the Protected Instream Flow to a very limited degree. Greenville's water supply source is the Tobey Reservoir, which has a reserved capacity of 212.5 million gallons (652 acre-feet) for the Town's water supply, which is three times greater than Greenville's reported maximum annual water use of 67.4 million gallons (2001). Reduced water use will have little impact on river flow because the discharge from the Greenville waste water treatment plant is upstream from the discharge of the Tobey Reservoir. Given the low consumptive losses in the system, the Protected Instream Flow deficits are not substantially remedied by reduced use in the Greenville water system. As such, the Water Use Plan calls for actions such as outdoor use restrictions only when water supply capacity in Tobey Reservoir is low or other system infrastructure problems occur.

Greenville Water Works has an established Emergency Action Plan (Woodard & Curran Inc. 2009) with a multi-stage, outside water use reduction plan that applies during a water system emergency, which may include a drought.

Outside water use reduction will be accomplished by implementing the plans for outdoor water use reduction included in the Emergency Action Plan (Woodard & Curran 2009). Outdoor water use is heaviest during the summer and early fall. Under the Emergency Action Plan, outdoor water use will be reduced in three stages: an alert with voluntary water conservation, water use restrictions, and a water use ban.

The notification process for these actions is defined in the Town's Emergency Plan (Woodard & Curran 2009). The Greenville Water Department Project Manager with the assistance of the water treatment plant operators will implement water conservation notification at the Greenville Water Department. Greenville Water Department staff will use telephone and cable channel notification procedures and post notices to implement and cancel water conservation measures.

Nothing in Water Use Plan precludes the Town from implementing more restrictive water use actions on its own initiative.

**Estimated Water Use Plan Implementation Costs**

The water use management actions are the implementation of outside water use reductions or bans only when water supply capacity in Tobey Reservoir is low or other system infrastructure problems occur. There are no additional direct costs associated with the implementation of these water use management actions.

**Water Use Plan Implementation Schedule**

By June 1, 2014, the Town of Greenville will implement its Water Use Plan by instituting the measures to support the protected instream flows on the Souhegan Designated River during the GRAF Spawning and Rearing & Growth bioperiods from June 15 to September 30.

**Water User Contact Information**

**Water User**: Town of Greenville
**Address**: P.O. Box 343, Greenville, NH 03048
**Contac**t: Carla Mary
**Phone**: 878-1338
**Email**: cmary@woodardcurran.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc. NHDES-R-WD-06-50.

Personal communication with Carla Mary, Woodard and Curran, contractor for Town of Greenville.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed with input from Carla Mary, Woodard and Curran, contractor for the Town of Greenville.

Woodard & Curran, Inc. 2009. Town of Greenville Water Treatment Facility Emergency Action Plan.

Water use reports on file with the Department of Environmental Services (DES).

**WATER USE PLAN**

**Milford Fish Hatchery (#20218)**

## Introduction

The following individual Water Use Plan (WUP) has been prepared for the New Hampshire Fish and Game Department's Milford Fish Hatchery. This WUP was prepared using information provided by Milford Fish Hatchery and from their water use records reported to the Department of Environmental Services (DES). The Milford Fish Hatchery has two overburden water supply wells that are located north of the Souhegan Designated River, west of the hatchery facility just off North River Road in Milford, New Hampshire. The water pumped from these two wells is the source water for the fish hatchery operations. The hatchery raises trout for stocking in New Hampshire streams.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Milford Fish Hatchery is considered an Affected Water User (AWU) because its registered water sources are within 500 ft of the Souhegan Designated River or its tributaries and its registered water sources are within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

The Milford Fish Hatchery has two registered ground water wells, Well #4 (20218-S01, also known as the River Well) and Well #1 (20218-S02, also known as the Field Well). Much of the water used by the fish hatchery is returned to the Souhegan via an outfall above Purgatory Brook, a tributary to the Souhegan River (20218-D01).

Groundwater is withdrawn almost continuously since the wells are the water supply source for the fish hatchery and fish are cultivated year round. A separate water supply well is used to provide potable water to the hatchery facility. There is no water storage facility at the fish hatchery.

Although the water source is groundwater, due to the fact that these wells are located in a stratified drift formation that is connected to the Souhegan River, the wells intercept water that would be flowing in or just below the Souhegan River. An analysis of induced recharge by these wells was performed as part of the Instream Flow Study (DES 2005). The results of the analysis indicate that for the average pumping rates, the River Well induces 22 percent of its extraction from the river and the Field Well induces 35 percent of its extraction from the river.

The hydrologic conditions of the Souhegan River and other water use activities near the Milford Fish Hatchery wells are complex. Much of the water captured by these wells is likely returning to the Souhegan River thousands of feet downstream at or beyond where the fish hatchery return is occurring. The OK Tool Superfund Site returns water to the aquifer up-gradient of the fish hatchery wells. The Savage Superfund Site returns water to the aquifer and to the river just downstream of the fish hatchery wells, artificially augmenting both stream flow and the aquifer. The water returned from the fish hatchery enters Purgatory Brook which parallels and then re-enters the Souhegan River approximately one mile downstream from the wells. Because the complex hydrogeology does not match some of the assumptions used to generate the induced recharge estimates, there are some uncertainties regarding the impacts of pumping on stream flow.

**Water Use Patterns**

Water use is continuous and supports the needs of the aquiculture production at the fish hatchery. The groundwater pumped from the aquifer is free of fish pathogens, thereby limiting the potential for disease, and its nearly constant temperature provides cooling conditions for the fish in the summer and warmth during the winter.

The two wells pumps at different rates; the River Well (20218-S01) is pumped at a constant rate of 1,100 gallons per minute (or gpm), while the Field Well (20218-S02) has a more variable pumping rate between 400 and 800 gpm. Groundwater pumping is metered, recorded monthly and reported quarterly to the DES.

The Milford Fish Hatchery water use data for the years of 1988 through 2008 were obtained from the DES and are summarized in Figures 1, 2, and 3 as well as in Tables 1, 2, and 3. Water use records were incomplete for 1988, so they are not included in the annual use summaries. The first complete year of water use was reported for 1989.

Between 1989 and 2008 annual pumpage from the Milford Fish Hatchery wellfield ranged from a high of 1,030 million gallons (2000) to a low of 236 million gallons (1992), and average use was 803 million gallons (Figure 1 and Table 1). During this period, water use increased from 1989 to 1999, but has since stabilized and is typically on the order of 900 million gallons per year (Figure 1). From 1989 through 2008, water use increased by 357 million gallons or 67 percent. This represents an increase of 17.8 million gallons a year or 3.3 percent a year over the 20 year period.

The flattening of annual water use beginning in the early 2000s is due to the implementation of a stable production target of trout for fisheries management of the Souhegan River and many other rivers in the southwestern part of the state. There are no plans to expand production for any reason at this time and annual water use is not expected to increase in the near future.

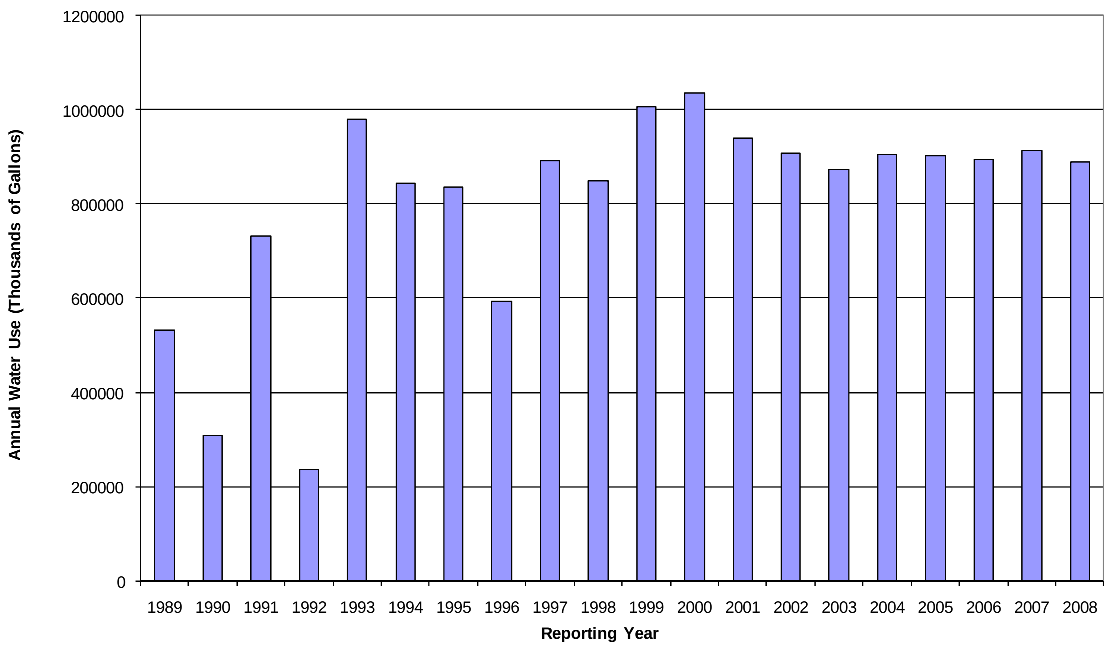


**Figure 1 – Milford Fish Hatchery Annual Water Use 1989 through 2008**

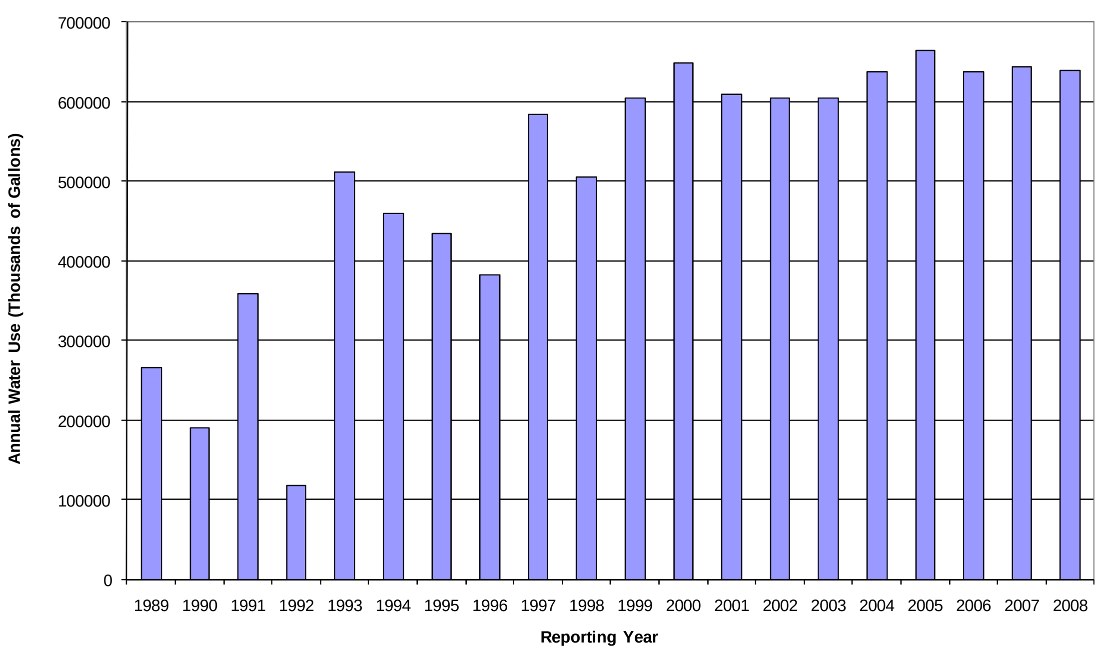


**Figure 2 – Milford Fish Hatchery River Well Annual Water Use 1989 through 2008**

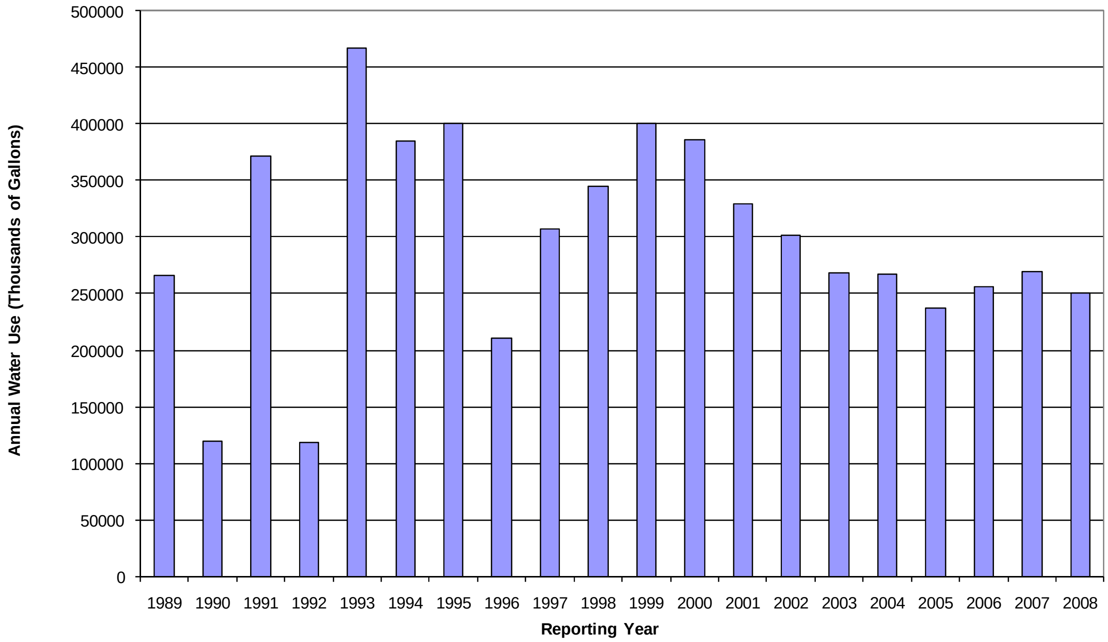


**Figure 3 – Milford Fish Hatchery Field Well Annual Water Use 1989 through 2008**

**Table 1 – Milford Fish Hatchery Annual Water Use Statistics (Combined Wells 1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 236,000 | 1,030,000 | 803,000 |
| (cfs) | 1.000 | 4.390 | 3.410 |
| (cfsm at impact point) | 0.009 | 0.037 | 0.029 |
| (cfsm at Merrimack Gage) | 0.006 | 0.026 | 0.020 |

**Table 2 – Milford Fish Hatchery River Well Annual Water Use Statistics (1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 118,000 | 663,000 | 505,000 |
| (cfs) | 0.500 | 2.820 | 2.140 |
| (cfsm at impact point) | 0.004 | 0.024 | 0.018 |
| (cfsm at Merrimack Gage) | 0.003 | 0.016 | 0.013 |

**Table 3 – Milford Fish Hatchery Field Well Annual Water Use Statistics (1989-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 118,000 | 663,000 | 505,000 |
| (cfs) | 0.500 | 2.820 | 2.140 |
| (cfsm at impact point) | 0.004 | 0.024 | 0.018 |
| (cfsm at Merrimack Gage) | 0.003 | 0.016 | 0.013 |

The monthly water use records for the Milford Fish Hatchery begin in October 1988. Average monthly water use varies in a narrow range (Figures 5, 6, and 7), but follows seasonal trends. This seasonal variation reflects the growing season pattern and fish biomass and the water needs for loading capacity. The higher water use during the late winter (March) is due to the timing of the fish biomass reaching its peak. Fish are then distributed out of the facility from April through June, resulting in a lower biomass and lower water use. The next generation (year-class of trout) grows up in July to September, so biomass increases during this period along with a corresponding increase in water use.

The very high variability (maximum versus minimum) in monthly water use shown in Figures 4, 5, and 6 is related to the period of increasing use from 1988 to 1999. Since 1999, the variability in annual water use along with monthly water use has lessened considerably due to a more stable production target of trout. Monthly water use statistics are shown in Tables 4, 5, and 6. The highest total monthly water use by the fish hatchery wells was 1,104 million gallons (December 2000), the lowest total monthly use was 3.24 million gallons (November 1991), with an average monthly use of 73.4 million gallons (Figure 4 and Table 4).

The monthly water use data for the Milford Fish Hatchery were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (117 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the average daily water use for the fish hatchery wells has ranged from a minimum of 0.167 cfs (107,935 gallons per day, November 1991) to a maximum of 5.19 cfs (3.35 million gallons per day, December 2000), and average use was 3.74 cfs (2.42 million gallons per day) for the period of 1988 to 2008 (Table 2).

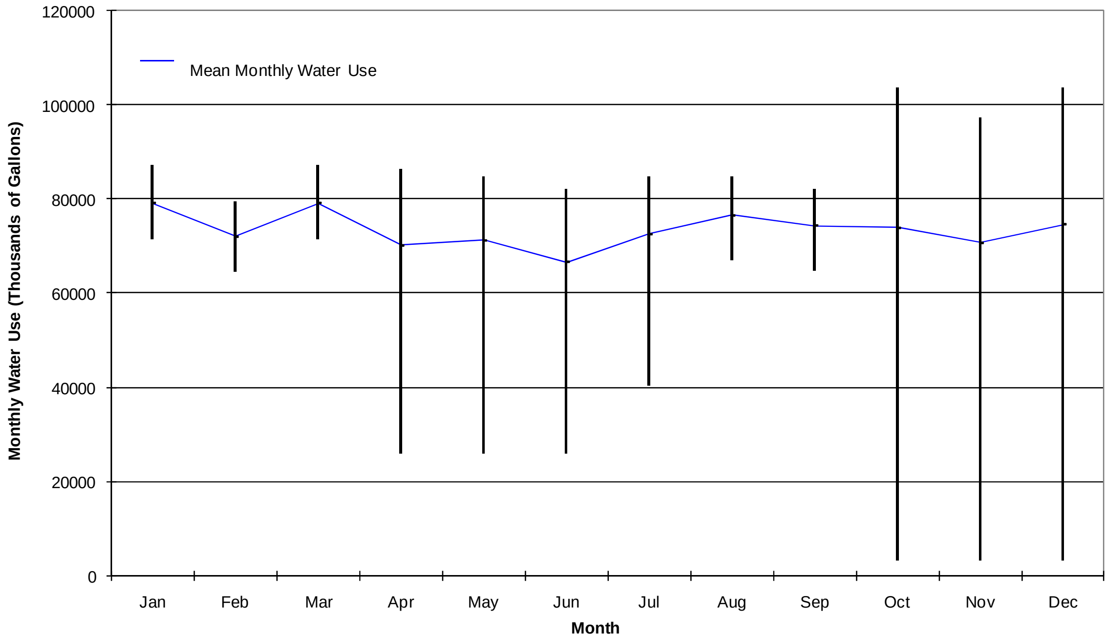


**Figure 4 – Milford Fish Hatchery Monthly Water Use 1988 through 2008**

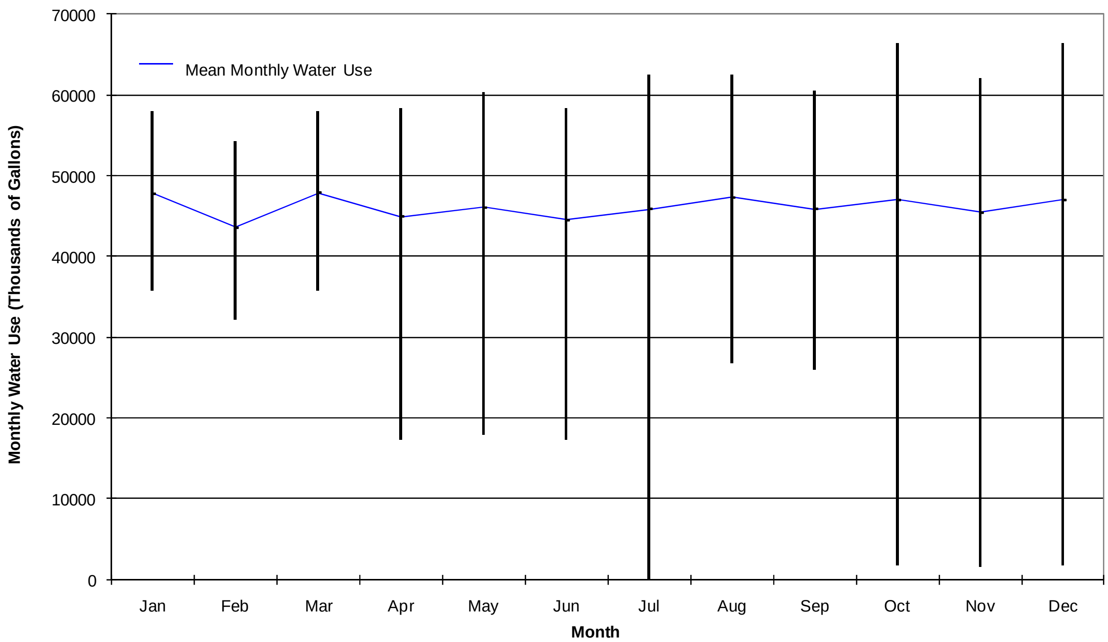


**Figure 5 – Milford Fish Hatchery River Well Monthly Water Use 1988 through 2008**

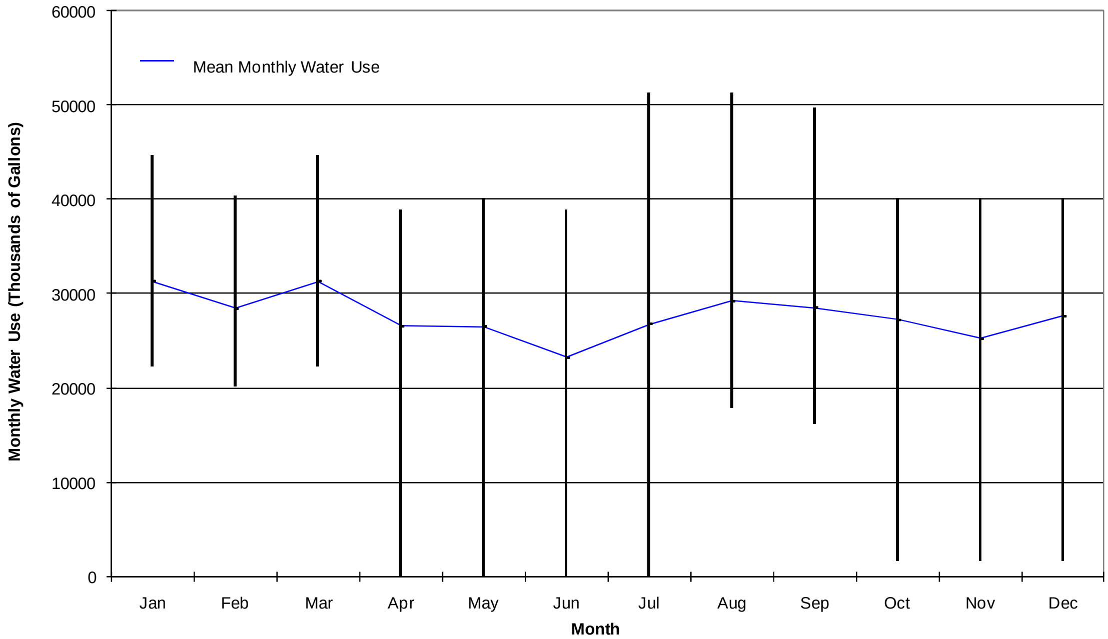


**Figure 6 – Milford Fish Hatchery Field Well Monthly Water Use 1988 through 2008**

**Table 4 – Milford Fish Hatchery Monthly Water Use Statistics (Combined Wells 1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 3,240 | 104,000 | 73,400 |
| (cfs) | 0.167 | 5.190 | 3.740 |
| (cfsm at impact point) | 0.001 | 0.044 | 0.032 |
| (cfsm at Merrimack Gage) | 0.001 | 0.030 | 0.022 |

**Table 5 – Milford Fish Hatchery River Well Monthly Water Use Statistics (1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 0 | 66,300 | 46,000 |
| (cfs) | 0 | 3.310 | 2.340 |
| (cfsm at impact point) | 0 | 0.028 | 0.020 |
| (cfsm at Merrimack Gage) | 0 | 0.019 | 0.014 |

**Table 6 – Milford Fish Hatchery Field Well Monthly Water Use Statistics (1988-2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 0 | 51,300 | 27,600 |
| (cfs) | 0 | 2.560 | 1.410 |
| (cfsm at impact point) | 0 | 0.028 | 0.020 |
| (cfsm at Merrimack Gage) | 0 | 0.015 | 0.008 |

**Potential for Water Use Management to Meet Protected Instream Flows**

The potential for the management of water use by Milford Fish Hatchery to support the protected instream flows on the Souhegan Designated River is low. Its water supply consists of two production wells, which are the sole source of water to the hatchery. The operation of the wells has been shown to induce infiltration from the river (DES 2005) under average pumping rates. However, as noted above, there are uncertainties in the calculation of induced flows for this location. Options to reduce the impact of ground water withdrawals on the river to support the protected instream flows include: reduced pumping rate of the wells; supplementing the existing ground water supply with an additional water supply source; pumping return water to the affected part of the river; or, some combination of these options. Due to the operational requirements of the hatchery, reduction in water use is not a viable option. A new water supply source at this scale would have to be ground water and to limit its effect on flows in the Souhegan Designated River, it would have to be located and operated so that pumping from the new well would not induce recharge from the river.

**Water Use Plan Activity**

One option to reduce the effects of pumping by reducing the pumping from wells inducing recharge from the Souhegan River. Under average pumping rates the two production wells at the Milford Fish Hatchery extract between 22 and 35 percent of their water from the Souhegan Designated River via induced infiltration. Based on the results of an analysis of the effects of the well withdrawals on the river (DES 2005), to eliminate induced infiltration pumpage of the Field and the River wells would have to be reduced by between 30 and 50 percent, under average conditions. These reductions would be required during the summer and early fall at times when stream flows on the river fall below the protected instream flow levels. If additional water is required to support the hatchery operations, the reduction in pumping from the existing wells could be offset by pumping from a new well(s) that is located at a sufficient distance from the river to minimize induced infiltration.

Under this option, reductions in pumping from the existing water supply wells will occur when daily mean discharge in the Souhegan Designated River falls below the Rare protected flow level of 17 cfs during the period of June 15 to September 30 for longer than the 10 day, catastrophic duration (DES 2008). The lowest flows in the Souhegan River typically occur during this period and lowering these flows by pumping would further increase stress on aquatic organisms in the river. The need for reduction in production from these two wells may be offset by pumping from a new well(s) as long as it does not induce infiltration from the Souhegan Designated River. The reduction in pumping from the Field and River wells is rescinded when daily mean discharge caused by natural recharge exceeds 17 cfs for two consecutive days.

The prompt for this water use action will be determined from daily flow measurements at the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire. The Milford Fish Hatchery will act on its Water Use Plan based on mean daily flow conditions at this gage or based on conditions defined the DES web page: http://www2.des.state.nh.us/OneStopPub/Watershed/souhegan-lower-pisf-track.xls.

Alternatively, during low flow conditions, sufficient water to offset the induced recharge effecting stream flow could be discharged in the vicinity of the existing pumping wells. This option would require another discharge permit for this location.

Both alternatives of finding an alternate water source and returning water to the vicinity of where it was induced from stream flow are costly. Funding is currently unavailable from the State to support these activities. Further, the quantification of the flow needs for these alternatives is uncertain and affects the costs.

Therefore, the recommended activity prior to determining the course of further management is to determine the effects of fish hatchery pumping and other water uses in the vicinity on stream flow by conducting groundwater modeling. The model will be required to quantify effects of water use on the natural stream flow and determine the volume and location of corrective actions needed over the range of conditions occurring throughout the year. Such a model could expand on the one created for the Milford-Souhegan aquifer including where the fish hatchery wells and the Souhegan River exist.

**Estimated Water Use Plan Implementation Costs**

If additional water is required to maintain the operation of the fish hatchery during periods of reduced production from the existing wells, a new ground water supply source will have to be investigated, permitted and installed. The estimated cost for the completion of these tasks is dependent upon the number of wells that would need to be developed, the level of effort required to find a new ground water source, to evaluate its potential for development, to address any site specific permitting issues and the cost of its installation. These costs could range from several hundred thousand dollars to over a half a million dollars.

Costs for modeling the effects of pumping withdrawals on the Souhegan River between the fish hatchery wells and the return flow at Purgatory Brook are estimated to at $50,000 to $125,000. Any changes in water withdrawal or return necessary after these steps are taken must also be included. The cost for these changes may be none to the cost for a developing and permitting a new groundwater source identified above. Regardless, the model would be required at this level of detail as part of the state's groundwater permit process if a new source is required as the alternative.

**Water Use Plan Implementation Schedule**

By June 1, 2014, the Milford Fish Hatchery will implement its Water Use Plan and will institute the measures required to support the protected instream flows on the Souhegan Designated River during the GRAF Spawning and Rearing & Growth bioperiods from June 15 to September 30.

**Water User Contact Information**

**Water User**: New Hampshire Fish and Game Department
**Address**: 408 North River Road, Milford, NH 03055
**Contac**t: Jason Smith

**Phone**: 271-2501
**Email**: Jason.Smith@Wildlife.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc. NHDES-R-WD-06-50.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc.

Water use reports on file with the Department of Environmental Services (DES).

# WATER USE PLAN

## Milford Water Works (#20100)

## Introduction

The following individual Water Use Plan (WUP) has been prepared for Milford Water Works, which serves as the public water supplier for the Town of Milford, New Hampshire. This WUP was prepared using information provided by Milford Water Works and from their water use records reported to the Department of Environmental Services (DES). Milford Water Works has two registered water sources that are located off Merrimack Road and north of the Souhegan Designated River in Amherst, New Hampshire.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Milford Water Works is considered an Affected Water User (AWU) because its registered water source is within 500 ft of the Souhegan Designated River and its registered water source is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

The Milford Water Works supply source consists of three wells, Curtis Wells #1, #2, and #2A as a wellfield under one registration (20100-S01). Groundwater is withdrawn continuously since the water is the principal water supply for the Town of Milford. When demand exceeds supply from the wellfield, the town purchases additional water from the Pennichuck Water distribution system. In 2008, the Curtis Wells supplied 88.6 percent of the water needed and the remaining 11.4 percent was purchased from Pennichuck Water. The Town water system also includes 1.25 million gallons of storage.

The Town of Milford recently applied to DES for the approval of a new drinking water supply well for their system. The new well (Curtis Well #2A) was developed as source to serve as a backup to existing Well # 2 at the Curtis Wellfield. Well # 2 has declined in specific capacity in recent years and this backup well will allow for full utilization of the wellfield production.

Although the water source is groundwater, due to the fact that these wells are located in a stratified drift formation that is connected to the Souhegan River, the wells intercept water that would be flowing in or just below the Souhegan River. An analysis of induced recharge by these wells was performed as part of the Instream Flow Study (DES 2005). The results of the analysis indicated that Curtis Well #1 does not induce Souhegan River water recharge at its average or maximum reported extraction rates. About 60 percent of the Curtis Well #2 extraction is induced recharge for its long-term average pumping rate.

## Water Use Patterns

Water use in the town is continuous and the Curtis Wells provide sufficient water to supply most of the community water supply needs. The primary wells are pumped at a fairly uniform rate, 700 gallons per minute (or gpm). When pumping exceeds demand, excess water fills storage, and when pumping is less than demand, stored water makes-up the difference. Groundwater pumping is metered, recorded monthly, and reported to the DES quarterly.

Water use data for the Milford Water Works for the years of 1989 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 and Tables 1 and 2. Unfortunately, each well does not have its own meter and therefore the withdrawal data include the combined well pumping.

Between 1989 and 2008 annual pumpage from the Curtis Wellfield ranged from a high of 374 million gallons (1998) to a low of 211 million gallons (1990), and average use was 307 million gallons (Figure 1 and Table 1). During this period, annual water use from the Curtis Wellfield increased by 87.6 million gallons or 36.2 percent. This represents an increase of 4.4 million gallons a year or 1.8 percent per year over the 20 year period. As shown in Figure 1, water use increased from 1989 to its maximum in 1998 and since then has ranged from 305.9 million gallons (2006) to 364.4 million gallons (2007). The plateau in water use reflects the supply limitation of the Curtis Wellfield and a contracted cap on the water available from Pennichuck Water. As a result, the Town of Milford is in the process of permitting an additional water supply well for the system.

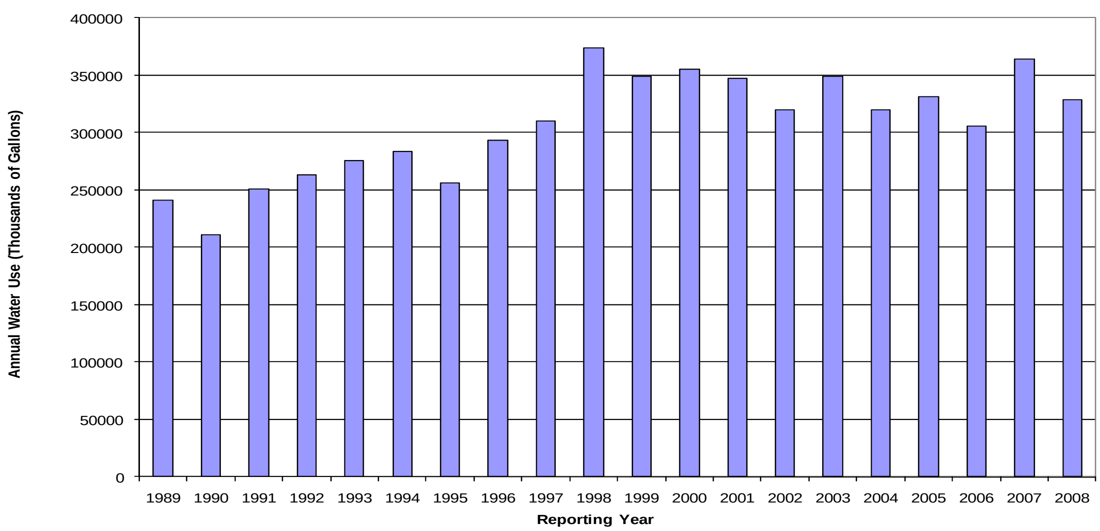


**Figure 1 – Milford Water Works Annual Water Use 1989 through 2008**

**Table 1 – Milford Water Works Annual Water Use Statistics (1989 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 211,000 | 374,000 | 307,000 |
| (cfs) | 0.894 | 1.590 | 1.300 |
| (cfsm at impact point) | 0.006 | 0.011 | 0.009 |
| (cfsm at Merrimack Gage) | 0.005 | 0.009 | 0.008 |

The monthly water use records for the Curtis Wellfield begin in October 1988. Monthly water use varies in response to weather conditions and changes in seasonal demand. The total and average monthly water usage was highest during summer and lowest during winter. This seasonal pattern reflects increased outdoor water usage (lawn irrigation, garden watering, vehicle washing, etc.) during the summer months, which then declines during the fall; remains low during the winter and begins to increase again in the spring. The highest total monthly use for the Curtis Wellfield was 38.4 million gallons (August 2006), the lowest total monthly use was 8.41 million gallons (March 2002), with an average monthly use of 25.5 million gallons (Figure 2 and Table 2).

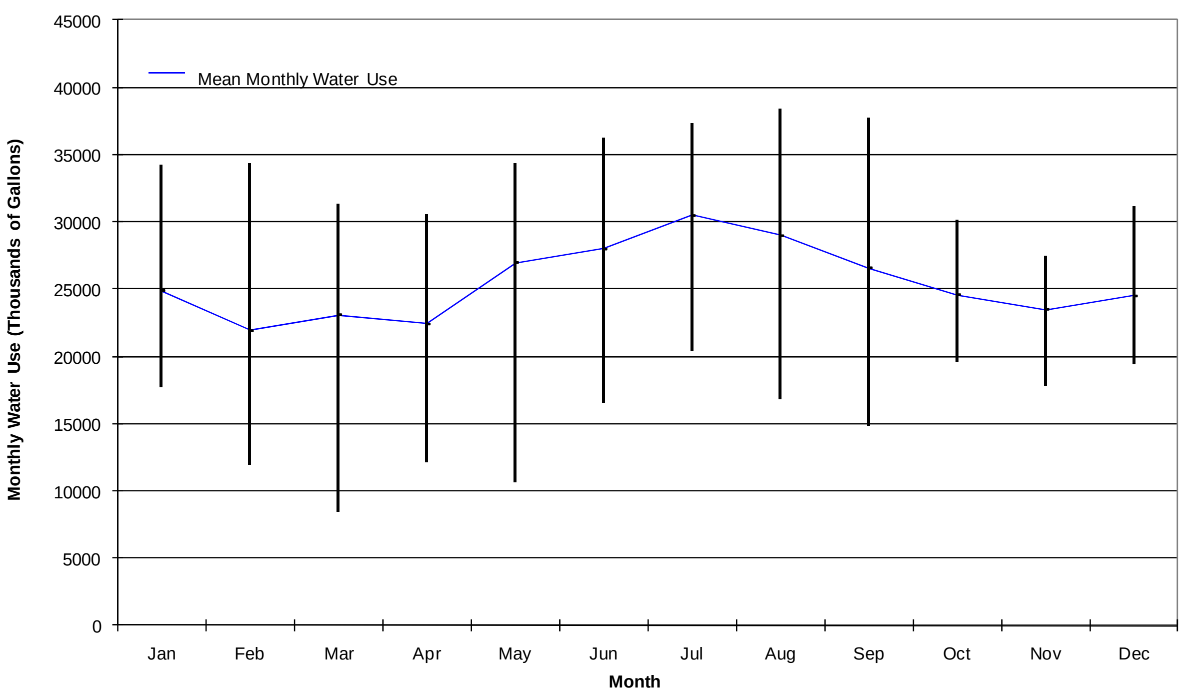


**Figure 2 – Milford Water Works Monthly Water Use 1989 through 2008**

**Table 2 – Milford Water Works Monthly Water Use Statistics (1988 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 8,410 | 38,400 | 25,500 |
| (cfs) | 0.420 | 1.920 | 1.300 |
| (cfsm at impact point) | 0.003 | 0.014 | 0.009 |
| (cfsm at Merrimack Gage) | 0.002 | 0.011 | 0.008 |

The monthly water use data for the Curtis Wellfield were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (139 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the average daily water use for the Curtis Wellfield has ranged from a minimum of 0.42 cfs (271,454 gallons per day, March 2002) to a maximum of 1.92 cfs (1.24 million gallons per day, August 2006), and average use was 1.30 cfs (840,216 gallons per day) for the period of 1988 to 2008 (Table 2).

**Potential for Water Use Management to Support Protected Instream Flows**

The potential for the management of water use by Milford Water Works to support the protected instream flows on the Souhegan Designated River is high. Milford's water supply consists of three production wells, only one of which (Curtis Well #2) has been shown to induce flow from the Souhegan Designated River. Use of this well could be reduced during the summer and early fall when flows on the Souhegan Designated River fall below the Critical or Rare protected instream flow levels by reducing water demand through the implementation of outdoor water use restrictions.

**Water Use Plan Activity**

Milford Water Works has an established Emergency Plan Guide (Milford Water Utilities Department 2009) that includes water conservation measures that can be implemented during an emergency or drought. Discussions with public water suppliers indicated an interest and willingness to coordinate reductions in outside water use that is linked with stream flow conditions in order to reduce system demand to support the protected flows.

Milford's Emergency Plan Guide (Milford Water Utilities Department 2009) includes only limited water conservation measures (odd/even day lawn watering program) that can be implemented during an emergency or drought. Outdoor water use reductions will be accomplished by implementing a multi-stage approach when outdoor water use is heaviest during the summer and early fall. The outdoor water use reduction plan will apply to the two bioperiods that correspond with the highest levels of water use, occurring from June 15 to September 30, and when flows in the Souhegan Designated River fall below the Critical and Rate protected instream flow levels (DES 2008). Under this Water Use Plan, outdoor water use will be reduced in three stages: an alert with voluntary water conservation, water use restrictions, and a water use ban.

The prompts for these water use actions are defined by the lower Souhegan Protected Instream flows (DES 2008) as determined from daily flow measurements at the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire. The Town will act on the Water Use Plan based on mean daily flow conditions at this gage or based on conditions defined on the DES web page at: http://www2.des.state.nh.us/OneStopPub/Watershed/souhegan-lower-pisf-track.xls.

The first action is an alert to its customers and town-wide that voluntary water conservation measures should be taken and that further actions may begin soon. The alert will be enacted by the Town on the day after daily mean discharge at the gage falls below 26 cfs during the GRAF Spawning and Rearing and Growth bioperiods (June 15-September 30). The Town will inform its water users through its notification process to implement voluntary water conservation measures and prepare for further actions. An alert may be rescinded when daily mean discharge from a natural recharge event exceeds 26 cfs for two consecutive days.

If daily mean discharge in the Souhegan Designated River continues to decline and fall below the Critical protected flow level of 26 cfs during the GRAF Spawning and Rearing and Growth bioperiods (June 15-September 30) for longer than the 20 day Catastrophic duration, then the Town will implement outside water use restrictions on the watering gardens, lawns, and other landscaped areas; the washing of cars, trucks, RV's, driveways, sidewalks, patios and decks along with the filling of swimming pools from the water system. These restrictions may be rescinded when daily mean discharge from a natural recharge event exceeds 26 cfs for two consecutive days.

If the daily mean discharge in the Souhegan Designated River falls below the Rare protected flow level of 17 cfs during the GRAF Spawning and Rearing and Growth bioperiods (DES 2008) for longer than the 10 day, Catastrophic duration, then a ban on outside water use will be imposed. The ban on outside water use may be rescinded or reduced to an earlier restriction level when daily mean discharge from a natural recharge event exceeds 17 cfs for two consecutive days.

Nothing in this Plan precludes the Town from implementing more restrictive water use actions on its own initiative.

Whenever operational considerations of the water system allow during periods when outdoor water use restrictions are recommended or during a ban on outdoor water use, the Town will manage pumping from its water supply wells to further minimize potential impacts to the Souhegan Designated River. This includes: 1) minimizing the withdrawal of groundwater from the well located closest to the river; 2) balancing this reduction with increased pumping from the well farthest from the river; and 3) operating the withdrawal at lower withdrawal rates over longer periods of time in preference to higher withdrawal rates for shorter periods.

**Estimated Water Use Plan Implementation Costs**

The water use management actions are the implementation of outside water use reductions or bans when flows on the Souhegan Designated River fall below the Critical or Rare protected instream flow levels during summer and early fall during periods exceeding the Catastrophic duration. There are no additional direct costs associated with the implementation of these water use management actions.

### Water Use Plan Implementation Schedule

By June 1, 2014, the Town of Milford will implement its Water Use Plan and will institute the measures required to support the protected instream flows on the Souhegan Designated River during the GRAF Spawning and Rearing & Growth bioperiods from June 15 to September 30.

### Water User Contact Information

**Water User**: Milford Water Works
**Address**: Town Hall, 1 Union Square, Milford, NH 03055-4240
**Contact**: Dave Boucher, Superintendent
**Phone**: 249-0660
**Email**: dboucher@milford.nh.gov

### Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

### Sources of Information


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc. NHDES-R-WD-06-50.

Milford Water Utilities Department 2009. Emergency Plan Guide, Community Public Water System, Town of Milford, New Hampshire.

Personal communication with Dave Boucher, Milford Water Works.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Mr. Larry Anderson, superintendent of the Town of Milford Water Utilities Department.

Water use reports on file with the Department of Environmental Services (DES).

## WATER USE PLAN

## Monadnock Mountain Spring Water, Inc. (#20621)

### Introduction

The following individual Water Use Plan (WUP) has been prepared for Monadnock Mountain Spring Water, Inc. which is a water bottling company. This WUP was prepared using information provided by Monadnock Mountain Spring Water, Inc. and from their water use records reported to the Department of Environmental Services (DES). Monadnock Mountain Spring Water, Inc. has two overburden water supply wells located near the water bottling plant in Wilton, New Hampshire. One is located off Intervale Road and the other is near Mansur Road. The water pumped from these wells is either bottled on site or shipped by truck to another bottling facility located in Massachusetts.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Monadnock Mountain Spring Water, Inc. is considered an Affected Water User (AWU) because one of its registered water sources is within 500 ft of the Souhegan Designated River. In addition, its registered water sources are within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

### Water Source and Uses

Monadnock Mountain Spring Water, Inc. has two registered ground water wells, the Mansur Road (20621-S01) and the Intervale Road (20621-S02) wells. Groundwater is withdrawn primarily during business hours (9 AM – 6 PM). Monadnock Mountain Spring Water, Inc. has 40,000 gallons of storage at the bottling facility, 30,000 gallons for spring water and 10,000 gallons for distilled water. Water is pumped from the wells to storage and from there to the bottling operations. Once a week 8,000 gallons of water are shipped via truck to another bottling operation located in Massachusetts, otherwise the spring water produced on site is used on site.

Although the water source is groundwater, due to the fact that these wells are located in a stratified drift formation that is connected to the Souhegan River, the wells intercept water that would be flowing in or just below the Souhegan River. An analysis of induced recharge by these wells was performed as part of the Instream Flow Study (DES 2005). The results of the analysis indicated that the wells do not induce river recharge at normal or maximum pumping rates.

## Water Use Patterns

Although water use has been reported for each well, over 90 percent of the reported data from 1995 – 2008 is identical for each well. That is because prior to the fall of 2008 the water use was estimated based on bottling production and the total water use was divided by half and reported for each well. In the fall of 2008, Monadnock Mountain Spring Water installed recording water use meters on each of the wells and reports this information to the DES quarterly.

Water withdrawal is near continuous during normal business hours. The wells are generally pumped at a uniform rate with recent meter based water use data showing that the Intervale Well provides 2/3rds of the total production, while the Mansur Road provides the remainder. When pumping exceeds demand, excess water fills storage, and when pumping is less than demand, stored water makes-up the difference for the bottling operations.

Water use data for Monadnock Mountain Spring Water, Inc. for the years of 1995 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 as well as in Tables 1 and 2.

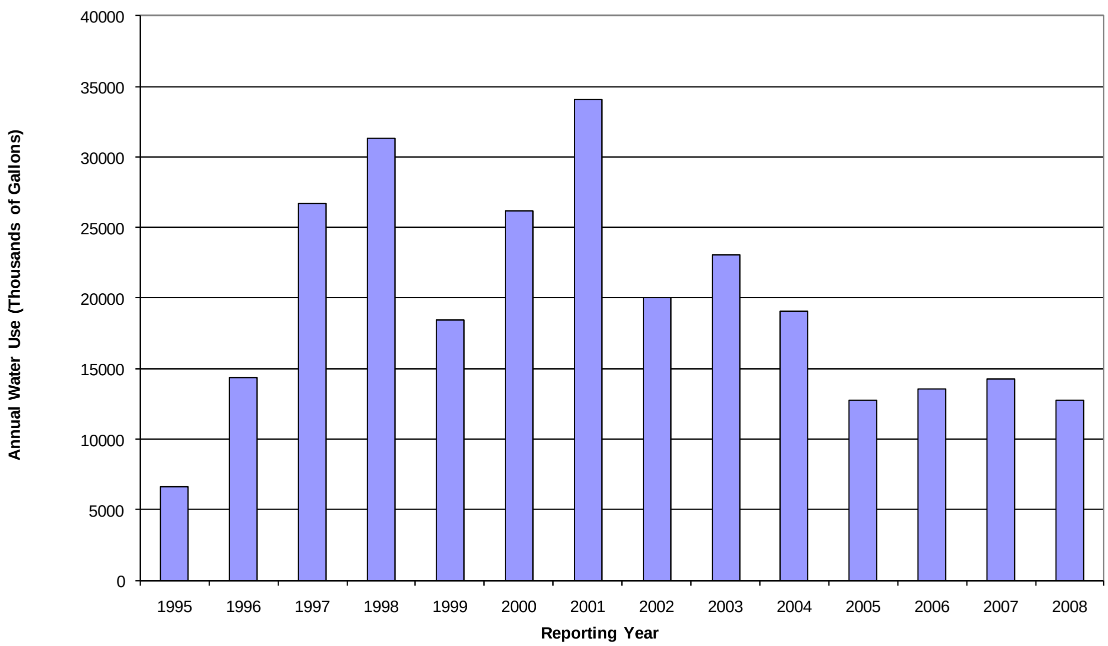


**Figure 1 – Monadnock Mountain Spring Water, Inc. Annual Water Use 1995-2008**

Between 1995 and 2008 annual water use by Monadnock Mountain Spring Water, Inc. ranged from a high of 34.1 million gallons (2001) to a low of 6.63 million gallons (1995), and average use was 19.5 million gallons (Figure 1 and Table 1). During this period, annual water use by Monadnock Mountain Spring Water, Inc. increased by 6.16 million gallons or 93 percent (Figure 1). This represents an increase of 440,000 gallons a year or 6.6 percent per year over the 14 year period. Annual water use reached a maximum of 34.1 million gallons in 2001, but since then it has dropped to within the range of 12.7 million gallons (2005) to 14.3 million gallons (2007), a decline of roughly 63 percent.

**Table 1 – Monadnock Mountain Spring Water, Inc. Annual Water Use Statistics (1995 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 6,629 | 34,107 | 19,515 |
| **(cfs)** | 0.0281 | 0.1447 | 0.0828 |
| **(cfsm at impact point)** | 0.0004 | 0.0023 | 0.0013 |
| **(cfsm at Merrimack Gage)** | 0.0002 | 0.0009 | 0.0005 |

Over the period of record, total monthly reported water use was highly variable, however, from month to month; the average water use varies in a narrow range (Figure 2). The highest mean monthly water use is in the summer (July), reflecting the increase in demand for bottled water, while the minimum mean monthly water use is during the fall/winter (Figure 2). The highest total monthly use was 3.73 million gallons (October, November and December 2001), the lowest total monthly use was 442,000 gallons (July, August and September 1995), and the average monthly use was 1.65 million gallons (Table 2).

The monthly water use data for the Monadnock Mountain Spring Water, Inc. wells were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (64 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the average daily water use by Monadnock Mountain Spring Water, Inc. has ranged from a minimum of 0.023 cfs (14,736 gallons per day in July, August and September 1995) to a maximum of 1.92 cfs (1.24 million gallons per day in October, November and December 2001), and average use was 0.09 cfs (53,515 gallons per day) for the period of 1995 to 2008 (Table 2).

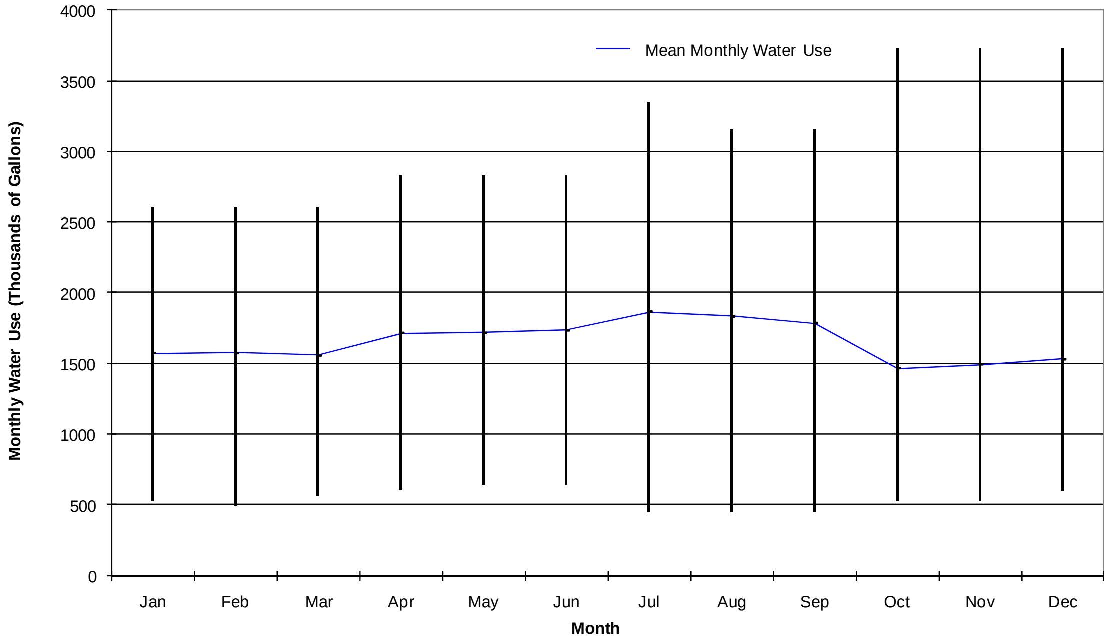


**Figure 2 – Monadnock Mountain Spring Water, Inc. Monthly Water Use 1995 through 2008**

**Table 2 – Monadnock Mountain Spring Water, Inc. Monthly Water Use Statistics (1995 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 442 | 3,733 | 1,653 |
| (cfs) | 0.0228 | 0.3250 | 0.0888 |
| (cfsm at impact point) | 0.0004 | 0.0051 | 0.0014 |
| (cfsm at Merrimack Gage) | 0.0001 | 0.0019 | 0.0005 |

## Potential for Water Use Management to Support Protected Instream Flows

Monadnock Mountain Spring Water, Inc. has limited potential to support the Protected Instream Flows on the Souhegan Designated River. Although its use of groundwater for on-site bottling and bulk shipments of water offsite for bottling are consumptive, the pumping of the source wells at their normal or maximum rates does not induce recharge from the river.

## Water Use Plan Activity

Since groundwater pumping at the Monadnock Mountain Spring Water, Inc. site does not induce recharge from the Souhegan Designated River, no water use management actions are required at this time.

## Estimated Water Use Plan Implementation Costs

Since no water use management actions are currently required for Monadnock Mountain Spring Water, Inc., there are no costs associated with the implementation of the plan.

**Water Use Plan Implementation Schedule**

Since no Water Use Plan actions are currently required for Monadnock Mountain Spring Water, Inc., there is no implementation schedule.

**Water User Contact Information**

**Water User**: Monadnock Mountain Spring Water, Inc.
**Address**: P.O. Box 518, 8 Mansur Road, Wilton, NH 03086
**Contac**t: Gary Boot
**Phone**: 654-2728
**Email**: monadnock3@tellink.net

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc.

Personal communication with Gary Boot, Monadnock Mountain Spring Water, Inc.

Water use reports on file with the New Hampshire Department of Environmental Services (DES).

**WATER USE PLAN**

**OK Tool Source Area (#20832)**

## Introduction

The following individual Water Use Plan (WUP) has been prepared for the OK Tool Source Area (also referred to as Operable Unit 1 or OU1) of the Savage Municipal Water Supply Well Superfund Site (Site ID #0101145). This WUP was prepared using information from the OK Tool site water use registration and water use data reported to the Department of Environmental Services (DES). There is an active groundwater pumping and treatment system at the site and treated groundwater is re-infiltrated to the aquifer via underground injection.

Under the Instream Flow Rules (Chapter Env-Wq 1900), the OK Tool site is considered an Affected Water User (AWU) because its registered water sources are within 500 ft of the Souhegan Designated River. In addition, its registered water sources are within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

The OK Tool site is the source area of a groundwater contamination plume in the Souhegan River aquifer. The source is now contained by a vertical, circular, subsurface, low permeability slurry wall. Groundwater is extracted from two six inch wells (20832-S01 and 20832-S02) within the containment area. The water is then treated for volatile organic compounds (VOCs) via air stripping and returned to the subsurface through a recharge trench (20832-D01) outside the slurry wall.

## Water Use Patterns

Water use is near continuous during normal treatment operations and the wells are generally pumped at a uniform rate (17 to 20 gallons per minute or gpm). Groundwater pumping is metered and is recorded monthly, as well as reported to the DES. Groundwater use data used for this report covered only part of 2008.

According to the water use registration forms on file with the DES, the OK Tool site wells are pumped at an average rate of 99,500 gallons per day (gpd) with a maximum rate of 178,560 gpd and an average annual use of 36,317,500 gallons. The water pumped from the extraction wells is returned to the aquifer through a recharge trench down-gradient of the extraction wells, thus, there is no net water consumption at this site.

Water use data for the combined well pumping at the OK Tool site for 2008 were obtained from the DES and are summarized in Figure 1 and Table 1. Since only a partial record of water use is available, only monthly data are presented. From April to December 2008 the highest total monthly water use was 2.9 million gallons (May), the lowest total monthly water use was 811,000 gallons (December), with an average monthly use of 2.2 million gallons.

The monthly water use data were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (103 sq. miles) of the Designated Reach above the impact point of the withdrawal.

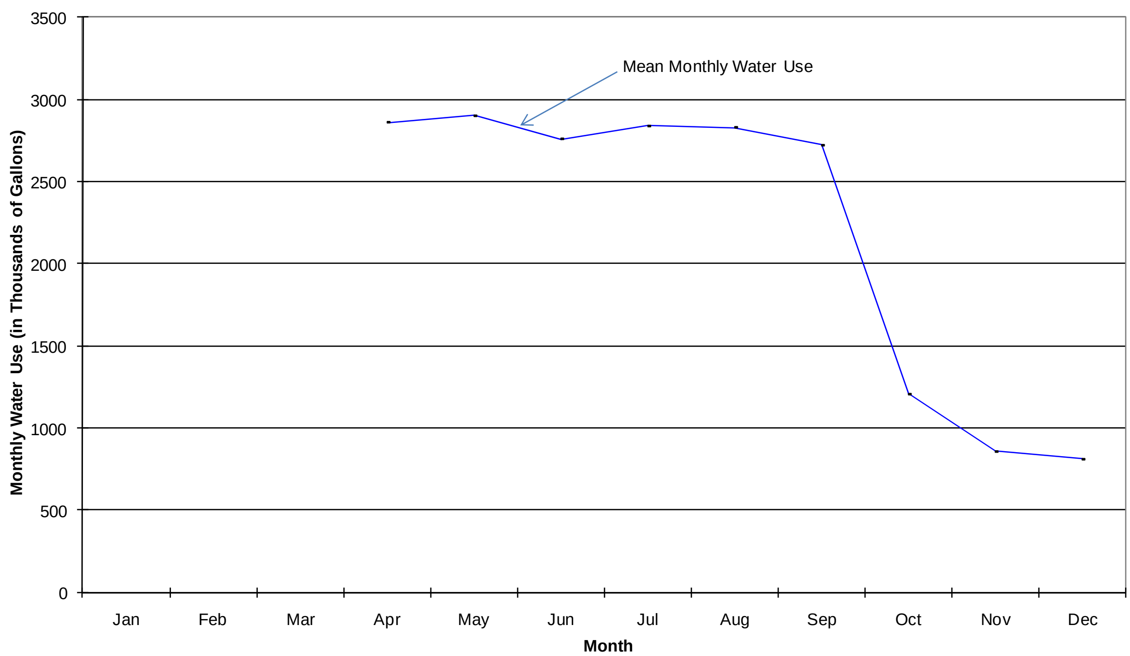


**Figure 1 – OK Tool Site Monthly Water Use for 2008**

Based on these values, the average daily water use for OK Tool has ranged from a minimum of 0.04 cfs (25,853 gallons per day in November and December) to a maximum of 0.15 cfs (96,948 gallons per day, April), and average use was 0.11 cfs (71,095 gallons per day) for 2008 (Table 1).

**Table 1 – OK Tool Site Monthly Water Use Statistics for 2008**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 811 | 2,900 | 2,190 |
| **(cfs)** | 0.0405 | 0.1450 | 0.1110 |
| **(cfsm at impact point)** | 0.0004 | 0.0014 | 0.0011 |
| **(cfsm at Merrimack Gage)** | 0.0002 | 0.0008 | 0.0007 |

### Potential for Water Use Management to Meet Protected Instream Flows

The OK Tool site has limited potential to support the Protected Instream flows since the water pumped from the extraction wells is returned to the Souhegan River aquifer on site through a recharge trench down-gradient of the extraction wells.

### Water Use Plan Activity

Since the groundwater withdrawn from the extraction wells at the OK Tool site is effectively recycled, no water use management actions are currently required for the site.

### Estimated Water Use Plan Implementation Costs

Since no water use management actions are currently required for the OK Tool site, there are no costs associated with the implementation of the plan.

### Water Use Plan Implementation Schedule

Since no Water Use Plan actions are currently required for the OK Tool site, there is no implementation schedule.

### Water User Contact Information

**Water User**: State of New Hampshire
**Address**: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
**Contac**t: Robin Mongeon
**Phone**: 271-7378
**Email**: Robin.Mongeon@des.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
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**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Water use registration forms on file with the Department of Environmental Services (DES).

Waste Site Cleanup & Reuse in New England – Savage Municipal Water Supply, United States Environmental Protection Agency, website: http://yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/83c7d221bb30028c8525691f0063f6f4!OpenDocument

## WATER USE PLAN

## Otis Falls Dam (#20229)

### Introduction

The following individual Water Use Plan (WUP) has been prepared for Otis Falls Dam, which is located on the Souhegan River in Greenville, New Hampshire. This WUP was prepared using information provided by Alden Engineering and from their water use records reported to the Department of Environmental Services (DES). The dam is a privately owned hydropower facility that is licensed by the Federal Energy Regulatory Commission (FERC Project No. 7921) and registered with the DES Dam Bureau (#101.01).

Under the Instream Flow Rules (Chapter Env-Wq 1900), Otis Falls Dam is considered an Affected Water User (AWU) because it is a registered water source within 500 ft of the designated segment of the Souhegan River. In addition, the dam is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

### Water Source and Uses

The source of water for the hydropower operations at Otis Falls Dam is the main stem of the Souhegan River and Mill Pond, the impoundment formed upstream of the dam. The dam is operated as run-of-river, meaning that the operation of the dam does not alter the flow of the river and that all of the water diverted through the hydroelectric operations is returned to the river.

If sufficient flow is available, the hydroelectric operations at Otis Falls Dam can produce power 24 hours a day, seven days a week, 365 days a year. Under the terms of its FERC license to operate the facility must allow for a minimum outflow of 10 cubic feet per second (cfs) during the summer (June through September) and 15 cfs during the winter (October through May). When the hydropower facility is not operating all of the flow goes over the top of the dam.

### Water Use Patterns

Water use data for the Otis Falls Dam for the period of 1988 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 as well as in Tables 1 and 2. Water use records for 1988 and 1989 were incomplete and water use data for 1999 and 2007 were missing so they are not included in the annual use summaries.

Water use by Otis Falls Dam is dependent on river flow. Between 1990 and 2008 annual water use by Otis Falls Dam ranged from a high of 7,820 million gallons (2006) to a low of 2,480 million gallons (2001), and average use was 5,380 million gallons for the 17 years that a complete annual record was available (Figure 1 and Table 1). Annual water use has not shown significant upward or downward trends and has mirrored water usage at other Souhegan River dams.

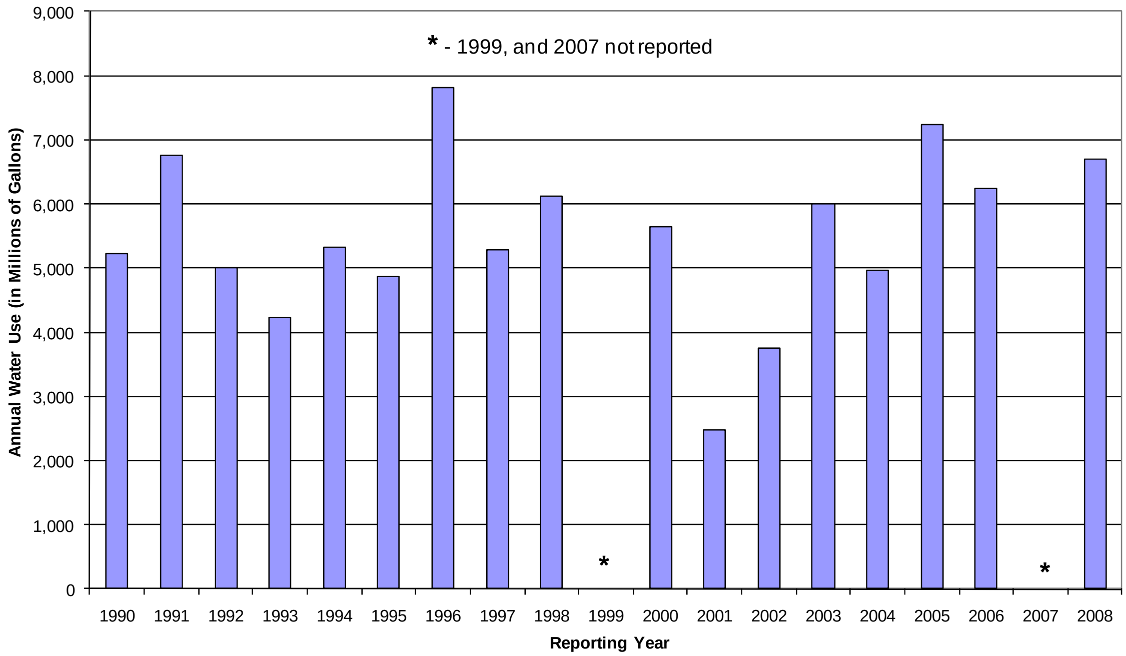


**Figure 1 – Otis Falls Dam Annual Water Use 1990 through 2008**

**Table 1 – Otis Falls Dam Annual Water Use Statistics (1990 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 2,480 | 7,820 | 5,500 |
| **(cfs)** | 10.50 | 33.20 | 23.40 |
| **(cfsm at impact point)** | 0.3560 | 1.1200 | 0.7940 |
| **(cfsm at Merrimack Gage)** | 0.0616 | 0.1940 | 0.1370 |

The monthly water use records for Otis Falls Dam begin in December 1988. The highest total monthly water use was 1,320 million gallons (April, 2008), the lowest total monthly water use was 192,000 gallons (September, 1989) with an average monthly use of 454 million gallons (Figure 2 and Table 2). Greatest monthly usage is usually during April, when river flows are highest and is typical for a run-of-river dam in New Hampshire.

The monthly water use data were converted from thousand gallons per month to cubic feet per second (cfs) by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor.  These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (29.5 sq. miles) of the Designated Reach above the impact point of the withdrawal.

Based on these values, the average daily water use for Otis Falls Dam has ranged from a minimum of 0.01 cfs (5,817 gallons per day, September 1989) to a maximum of 68.3 cfs (44,144 million gallons per day, April 2008), and average use was 23.1 cfs (14,930 million gallons per day) for the period of 1988 to 2008 (Table 2).

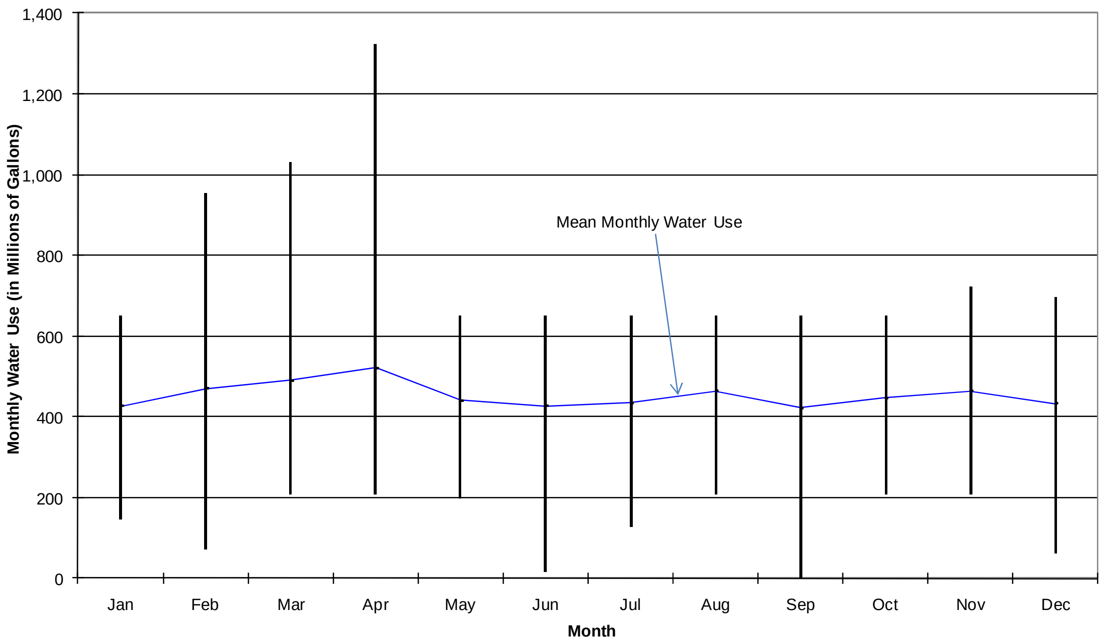


**Figure 2 – Otis Falls Dam Monthly Water Use 1988 through 2008**

**Table 2 – Otis Falls Dam Monthly Water Use Statistics (1988 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 0.192 | 1,320 | 454 |
| **(cfs)** | 0.01 | 68.30 | 23.10 |
| **(cfsm at impact point)** | 0.0003 | 2.3200 | 0.7840 |
| **(cfsm at Merrimack Gage)** | 0.0001 | 0.4000 | 0.1350 |

## Potential for Water Use Management to Support Protected Instream Flows

Otis Falls Dam has limited potential to manage its water use to support the Protected Instream Flows because it is operated on a run-of-river basis and is required to support minimum flows in the Souhegan Designated River as a condition of its FERC operating license.  By virtue of its management, the water use of the dam reflects the discharge of the river.

## Water Use Plan Activity

Since Otis Falls Dam is operated on a run-of-river basis, and is required to maintain minimum flows in the Souhegan Designated River, the only water use management action to be taken to support the protected instream flows is to pass relief flows un-attenuated from the dams located upstream during a water management action event.

## Estimated Water Use Plan Implementation Costs

Since the water use management action for Otis Falls Dam is to allow any relief flows to pass un-attenuated, there is no direct cost associated with the implementation of the plan.

## Water Use Plan Implementation Schedule

By June 1, 2014, Otis Falls Dam will implement its Water Use Plan and will institute the measures required to support the protected instream flows.

## Water User Contact Information

**Water User**: Alden Hydro LLC
**Address**: 69 Spring Hill Road, Sharon, NH 03458
**Contact**: Robert Greenwood
**Phone**: 603-924-5777
**Email**: greenwoodandson@aol.com

## Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) Dam Bureau, NHDAMS Data Sheet for Otis Falls Dam.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed with input from Robert Greenwood of Alden Engineering.

Water use reports on file with the Department of Environmental Services (DES).

**WATER USE PLAN**

**Peter de Bruyn Kops (#20383)**

## Introduction

The following individual Water Use Plan (WUP) has been prepared for Peter de Bruyn Kops, who operates a commercial farm located in Amherst, New Hampshire. This WUP was prepared using information provided by Mr. de Bruyn Kops and from the water use records reported to the Department of Environmental Services (DES). The farm produces various crops based on market demand. The farm borders the Souhegan Designated River and has historically withdrawn water from it for crop irrigation and occasionally for frost prevention.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Peter de Bruyn Kops is considered an Affected Water User (AWU) because his registered water source is within 500 ft of the Souhegan Designated River and his registered water source is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Although, his water sources are currently inactive, because his water use has been less than the threshold requiring reporting, Mr. de Bruyn Kops requested that he continue to be considered an AWU. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

Mr. Peter de Bruyn Kops registered with the DES in 1993 and reported water withdrawals from the Souhegan River (#20383) from 1994 through 2003. During this period though, water use only occurred in 1997, 1998 and 1999. The facility has been officially inactive as a water user since 2003 and has not reported water uses since that time. At the request of Mr. de Bruyn Kops, his farm operations are being included in the development of the Souhegan River Water Management Plan.

Since the early 2000s, the crops produced at the farm (hay, clover, canola, vegetables and flowers) have not required reportable levels of water use for irrigation. Records for surface water use by Mr. de Bruyn Kops are available from DES for the period of 1994 through 2003.

Water was withdrawn from the Souhegan Designated River via a removable pipe that is connected to an eight inch irrigation pipe. Water was withdrawn on an “as-needed” basis and used to irrigate a mixture of crops. After 1999, irrigation withdrawals from the river ceased since the majority of the farm is used for the production of hay (alfalfa, alfalfa-grass, clover-grass and grass), sweet clover and honeybee forage. Up to 1999, approximately six to ten acres were irrigated for the production of pumpkins and winter squash. Currently, less than an acre is used for the production of general vegetables and these have required some irrigation, but below the reporting threshold. Drip irrigation has been used on some vegetables during the past few years. The sources of water for this irrigation include both a domestic well and a withdrawal from an oxbow pond.

**Water Use Patterns**

Water use was on an as-needed basis, potentially 7 days per week and is weather dependent. On a daily basis water is used anytime it is needed. If less than one inch of water is provided by rainfall during a week, the remaining fraction of water is provided by irrigation, with irrigation generally done during daylight hours. Water use is not metered, but is estimated from the sprinkler flow rates.

Water use data for Peter de Bruyn Kops for the years of 1994 through 2003 were obtained from the DES and are summarized in Figures 1 and 2 and Tables 1 and 2. After 1999, Mr. de Bruyn Kops did not use river water for crop irrigation and, therefore, he stopped reporting withdrawals to the DES after 2003. Although his registration as a water user is now considered inactive, he may withdraw water from the Souhegan Designated River for irrigation again in the future, depending on which crops are grown and water availability (rainfall).

Water use varied from year to year and month to month, depending primarily on rainfall, weather conditions and the growing season. Annually, usage has ranged from a low of 0 gallons (multiple years) to a high of 520,000 gallons (1997) and has averaged 100,000 gallons for the reporting period (Figure 1 and Table 1). During this 10 year period (1994 through 2003), water was only withdrawn from the Souhegan Designated River in 1997, 1998 and 1999.

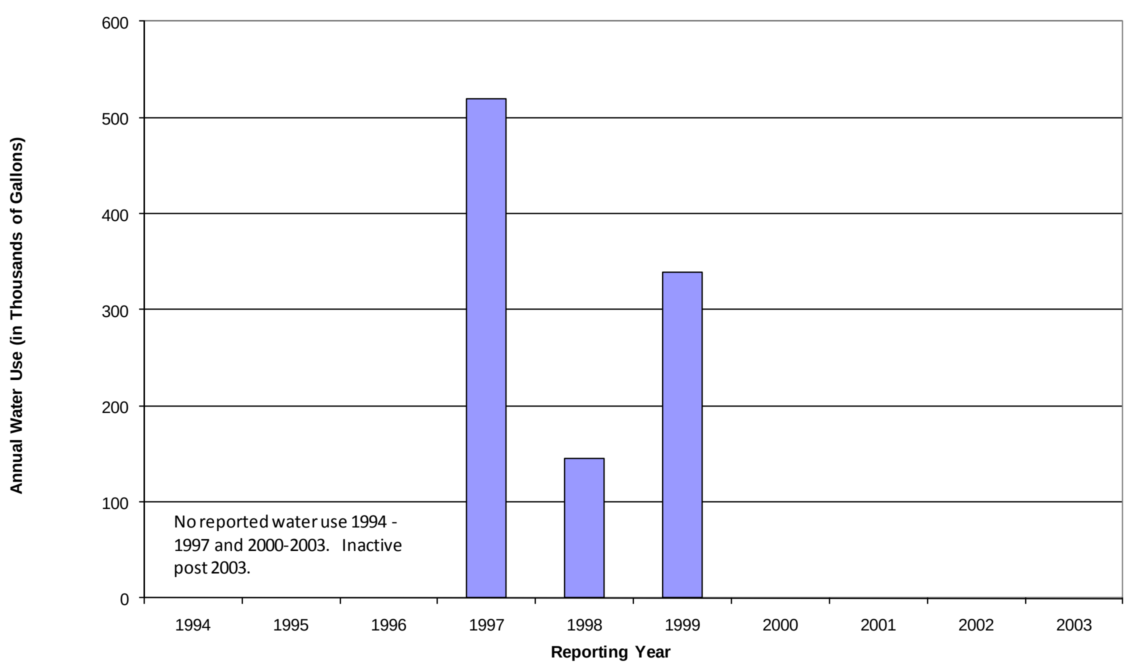


**Figure 1 – Peter de Bruyn Kops Annual Water Use 1994 through 2003**

**Table 1 – Peter de Bruyn Kops Annual Water Use Statistics (1994 through 2003)**

| | Low | High | Average |
|---|---|---|---|
| (1,000 gal) | 0 | 520 | 100 |
| (cfs) | 0 | 0.0022 | 0.0004 |
| (cfsm at impact point) | 0 | 0.00001 | 0.000003 |
| (cfsm at Merrimack Gage) | 0 | 0.00001 | 0.000003 |

Monthly water use changes seasonally with crop irrigation demand and rainfall. There has been no reported water use during the months of October through May due to plant dormancy conditions (Figure 2). The total and average monthly water usage was highest during the summer, specifically during August. The highest reported total monthly use of 178,000 gallons occurred in 1997. The average monthly use was 8,000 gallons, while the average monthly water use for the growing season months of April through October was 14,000 gallons (Table 2).

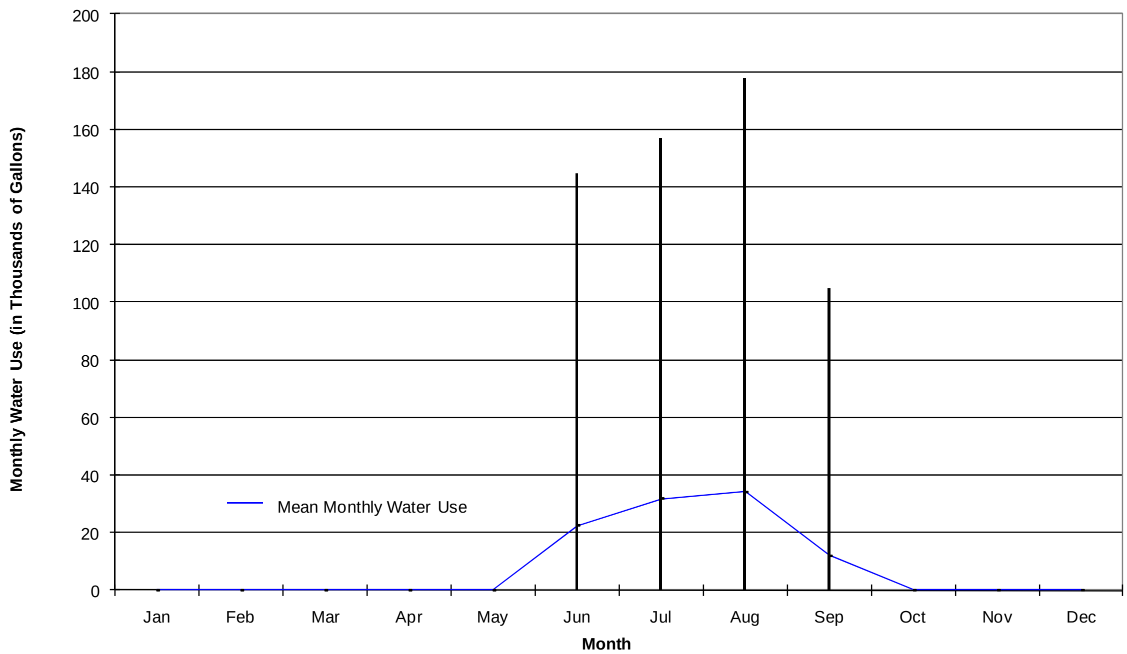


**Figure 2 – Peter de Bruyn Kops Monthly Water Use 1994 through 2003**

**Table 2 – Peter de Bruyn Kops Monthly Water Use Statistics (1994 through 2003)**

| | Low | High | Average | Apr - Oct avg |
|---|---|---|---|---|
| (1,000 gal) | 0 | 178 | 8 | 14 |
| (cfs) | 0 | 0.009 | 0.0004 | 0.007 |
| (cfsm at impact point) | 0 | 0.00006 | 0.0000003 | 0.00004 |
| (cfsm at Merrimack Gage) | 0 | 0.00005 | 0.0000003 | 0.00004 |

The monthly water use data were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (156 sq. miles) of the Designated Reach above the impact point of the withdrawal.

Based on these values, the average daily water use by Peter de Bruyn Kops has ranged from a minimum of 0 cfs (October through May in all years, all of 1994-1996, and all of 2000 through 2003) to a maximum of 0.009 cfs (5,817 gallons per day, August 1997) with an average of 0.007 cfs (4,524 gallons per day) for the April – October period and 0.0004 cfs (259 gallons per day) annually from 1994 through 2003.

**Potential for Water Use Management to Support Protected Instream Flows**

Management of Peter de Bruyn Kops' farm operations has limited potential to support the Protected Instream Flows on the Souhegan Designated River. Historical water use has been of low volume and since 2003; no water use has been reported to DES because the farm operations have been below the reporting thresholds.

**Water Use Plan Activity**

Management of Peter de Bruyn Kops' farm operations has limited potential to support the protected instream flows on the Souhegan Designated River unless water use changes from its current below reporting-threshold level. If water use by Peter de Bruyn Kops' farm operations meets the water use reporting threshold, Mr. de Bruyn Kops will be required to reduce his direct withdrawal from the Souhegan Designated River to the *de minimis* amount (Env-Wq 1902.07) when the daily mean discharge falls below the Critical protected flow for a period exceeding its Catastrophic duration, or when the daily mean discharge falls below the Rare threshold.

The *de minimis* amount for Mr. de Bruyn Kops, the Amherst Country Club/Ponemah Green Family Golf Center and Souhegan Woods Golf Club combined is 0.65 cfs (416,876 gallons per day), to be shared equally among those withdrawing water under this condition. The provisions of the Water Use Plan will not go into effect until Mr. Peter de Bruyn Kops re-activates his registration as a water user.

Alternatively, Mr. de Bruyn Kops may develop an alternative water supply that does not directly impact river flows, such a farm pond or well. Ideally, these water supplies would be hydrologically separated from the river by distance or intervening low permeability soils or both. As a rule of thumb, withdrawals located 500 feet or more from a tributary to the Souhegan River are considered hydrologically separate.

**Estimated Water Use Plan Implementation Costs**

The low water use by Peter de Bruyn Kops' farm operations means that there are no costs under current management. If water use increases above the reporting threshold, this water use plan would apply. Costs to implant this plan will depend on the level of increased use. Existing available alternative supply sources (*de minimis* or existing farm ponds) are available under low levels of use, and there are no direct costs associated with the implementation of these water use management options. If water use is greater than *de minimis*, and greater than the onsite sources can supply without affecting stream flow, then an additional cost of developing and permitting an alternate water supply would apply.

**Water Use Plan Implementation Schedule**

This Water Use Plan will go into effect upon Mr. Peter de Bruyn Kops re-activation of his registration as a water user and he will institute the measures for the management of irrigation water use during the summer and early fall when flows on the Souhegan Designated River fall below the Critical or Rare protected instream flow levels.

**Water User Contact Information**

**Water User:** Mr. Peter de Bruyn Kops
**Address:** 379 Amherst Street, #222, Nashua, 03063
**Contact:** Same as user
**Phone:** 603-673-8392
**Email:** dkb@acugen.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot | 43,560 | cubic feet |
| 1 | acre-foot | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc.

Personal communication with Mr. Peter de Bruyn Kops.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Peter de Bruyn Kops.

Water use reports on file with the Department of Environmental Services (DES).

**WATER USE PLAN**

**Pennichuck Water/Souhegan Woods (#20659)**

## Introduction

The following individual Water Use Plan (WUP) has been prepared for Pennichuck Water's Souhegan Woods Community Water System (CWS). This WUP was prepared using information provided by Pennichuck Water and from their water use records reported to the Department of Environmental Services (DES). Pennichuck Water's registered water source, a well, is located along the Souhegan Designated River. This CWS also has an interconnection with the Merrimack Village District as a supplemental water supply.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Pennichuck Water/Souhegan Woods is considered an Affected Water User (AWU) because its registered water source is within 500 ft of the Souhegan Designated River. In addition, its registered water source is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

Pennichuck Water provides water to the Souhegan Woods CWS from one overburden groundwater supply well (20659-S01). Groundwater is withdrawn from the well on a daily basis to provide drinking water and fire protection to the 115-home, Souhegan Woods subdivision. The system is interconnected with the Merrimack Village District (MVD) water supply which can be utilized as a supplemental water source.

Although the water source is groundwater, due to the fact that the pumped well is located in a stratified drift formation that is connected to the Souhegan River, the well intercepts water that supports stream flow in the Souhegan River. An analysis of induced recharge by this well was performed as part of the Instream Flow Study (DES 2005). The results of the analysis indicated that it does not induce Souhegan River water recharge at its average or maximum reported extraction rates.

## Water Use Patterns

Water use is daily and represents common community water supply needs moderated by system storage. Daily water demand follows a diurnal pattern, with the greatest water demand during the day (morning through evening) and lowest overnight.  The well pump runs about five hours per day during the low water use season (winter), and about 17 hours per day during the high water use season (summer), with most of the increased water demand for lawn irrigation.  The system includes 40,000 gallons of storage in two atmospheric tanks and 11,000 gallons in a hydropnuematic tank.  When pumping, the well is pumped at a uniform rate (~61 gallons per minute); when pumping exceeds demand, excess water fills storage, and when pumping is less than demand, stored water makes up the difference.  Groundwater pumping is metered and water use is recorded monthly and reported to DES quarterly.

Water use data for the Souhegan Woods CWS well for the years of 1998 through 2008 were obtained from DES and are summarized in Figures 1 and 2 as well as in Tables 1 and 2.  Water use records were incomplete for 1998, so 1998 was not included in the annual use summaries. The monthly summaries include both data from the years 1998 through 2008.

From 1999 through 2008, annual water use by the Souhegan Woods CWS well ranged from a high of 21.6 million gallons (2002) to a low of 7.94 million gallons (2004), and average use was 15.1 million gallons (Figure 1 and Table 1).  During this period, annual water use by Souhegan Woods CWS well has decreased by 5 million gallons or 27.5 percent.  This represents a decrease of 500,000 gallons a year or 2.8 percent per year averaged over the 10 year period.  Pennichuck Water credits the overall decline in water use to the increased use of water saving fixtures by residents and changing demographics within the community.

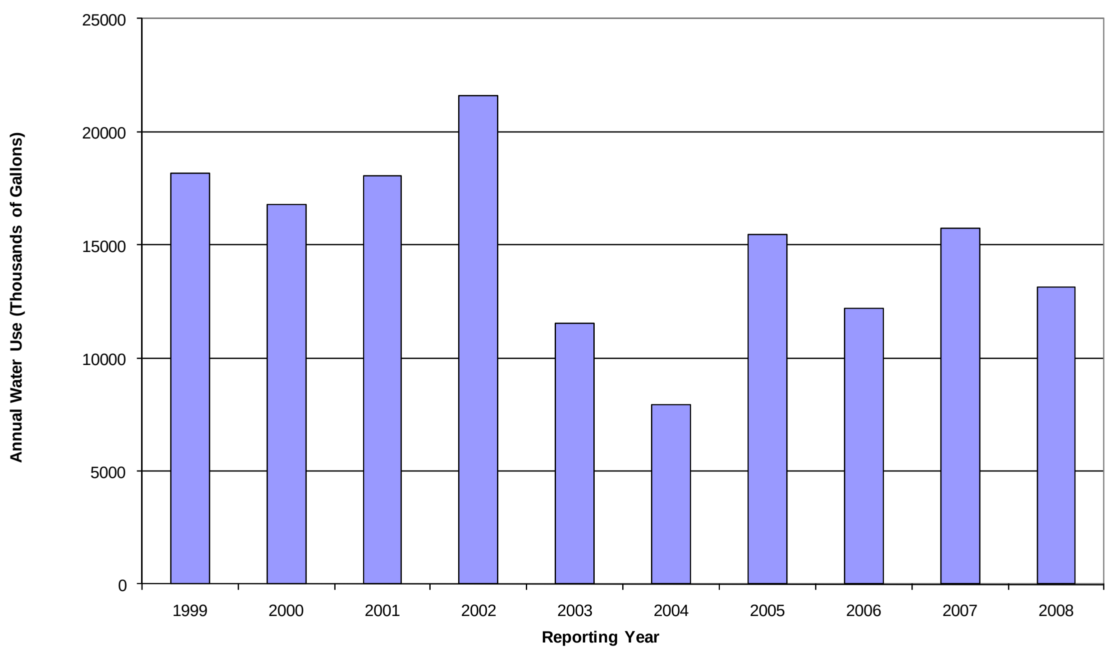


**Figure 1 - Pennichuck Water's Souhegan Well Annual Water Use 1999 through 2008**

**Table 1 – Pennichuck Water's Annual Water Use Statistics (1999 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 7,940 | 21,600 | 15,100 |
| **(cfs)** | 0.0337 | 0.0916 | 0.0639 |
| **(cfsm at impact point)** | 0.0002 | 0.0006 | 0.0004 |
| **(cfsm at Merrimack Gage)** | 0.0002 | 0.0005 | 0.0004 |

The monthly water use records for the system begin in July 1998. Monthly water use varies in response to weather conditions and changes in seasonal demand. For the system, the total and average monthly water usage was highest during the summer and lowest during the winter. This seasonal pattern reflects increased outdoor water usage (lawn irrigation, garden watering, vehicle washing, etc.) during the summer months, which then declines during the fall; remains low during the winter and begins to increase again in the spring. The highest total monthly use was 3.44 million gallons (August 2001), the lowest total monthly use was 145,000 gallons (December 2003), while the average monthly use was 1.24 million gallons (Figure 2 and Table 2).

The monthly water use data were converted from thousand gallons per month to cubic feet per second by dividing the monthly total by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (161 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the average daily water use by the Souhegan Woods CWS well has ranged from a minimum of 0.007 cfs (4,718 gallons per day, December 2003) to a maximum of 0.17 cfs (111,167 gallons per day, August 2001), and average use was 0.06 cfs (40,847 gallons per day) for the period of 1998 to 2008 (Table 2).

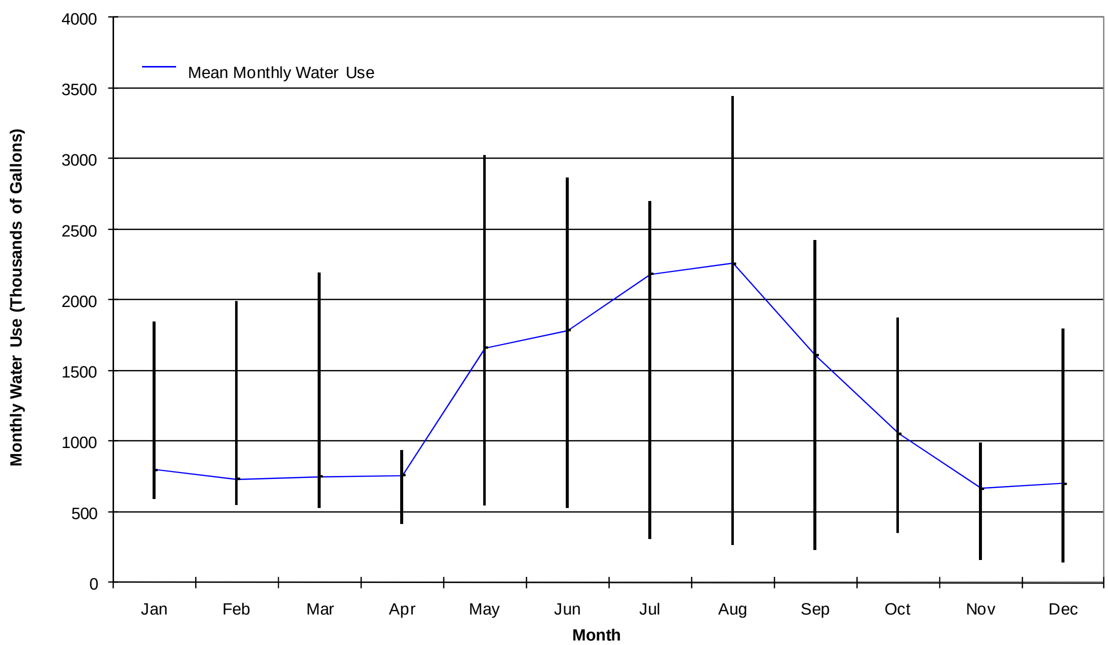


**Figure 2 - Pennichuck Water's Souhegan Well Monthly Water Use 1999 through 2008**

**Table 2 – Pennichuck Water's Monthly Water Use Statistics (1998 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 145 | 3,440 | 1,240 |
| (cfs) | 0.0073 | 0.1720 | 0.0632 |
| (cfsm at impact point) | 0.0001 | 0.0011 | 0.0004 |
| (cfsm at Merrimack Gage) | 0.00005 | 0.0010 | 0.0004 |

## Potential for Water Use Management to Support Protected Instream Flows

The potential for the management of water use by Pennichuck Water's Souhegan Woods well to support the protected instream flows on the Souhegan Designated River is low. The Souhegan Woods CWS is supported by one well, which is supplemented by water provided by the Merrimack Village District (MVD) with water supply sources located outside the Planning Area. The on-site source well for the Souhegan Woods CWS was evaluated for its potential to induce recharge from the Souhegan Designated River. The results of this analysis indicate that the well does not induce recharge from the river either at its average or maximum reported withdrawal rates.

In addition, since only one well provides water to the community system, Pennichuck Water already manages water demand during the summer using an odd/even lawn watering restriction. This well is shut off automatically if pumping levels get low and the system then runs exclusively off of the MVD water system. The system can run and supply odd/even water demands solely from the MVD supply, so if the well needs to be shut off, according to Pennichuck Water, they do not need to implement more stringent watering restrictions. Additional reductions in water use by the Souhegan Woods community system can be imposed by MVD, when it provides water to Souhegan Woods, through restrictions or bans depending on its system production and storage.

## Water Use Plan Activity

Pennichuck Water manages outdoor water use by the Souhegan Woods CWS during the summer using an odd/even lawn watering restriction. During periods of reduced groundwater availability, the on-site well is shut off and water is supplied by the MVD. The MVD can impose additional outdoor water use reductions on the Souhegan Woods CWS through restrictions or bans, depending on its system capacity.

Since the on-site water source has been shown to not directly impact the Souhegan River and the MVD located outside of the Planning Area, the existing water use management activities are accepted as part of this Water Use Plan and are to be continued. No other actions are required as part of this plan.

## Estimated Water Use Plan Implementation Costs

Since there is no change in activity in the Water Use Plan for Pennichuck Water's Souhegan Woods CWS, there are no costs.

**Water Use Plan Implementation Schedule**

Since there is no change in activity in the Water Use Plan for Pennichuck Water's Souhegan Woods CWS, implementation is continued as current practice.

**Water User Contact Information**

**Water User**: Pennichuck Water Works
**Address**: P.O. Box 1947, 25 Manchester Street, Merrimack, NH 03054-1947
**Contac**t: Donald Ware
**Phone**: 913-2330
**Email**: donald.ware@pennichuck.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Personnel communication with Don Ware, Pennichuck Water.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc.

Water use reports on file with the Department of Environmental Services (DES).

**WATER USE PLAN**

**Pilgrim Foods, Inc. (#20681)**

## Introduction

The following individual Water Use Plan (WUP) has been prepared for Pilgrim Foods, Inc., (Pilgrim Foods), which is a food production facility and is located off of Old Wilton Road in Greenville, New Hampshire. This WUP was prepared using information provided by Pilgrim Foods and from their water use records reported to the Department of Environmental Services (DES). Pilgrim Foods has used water from several sources as part of its operations. These sources include; the Town of Greenville water supply system, a well leased from the Town (Souhegan River Well) and two on-site ground water supply wells.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Pilgrim Foods is considered an Affected Water User (AWU) because two of its active registered water sources are within 500 ft of the Souhegan Designated River (20681-S03, the Davis Well) and a tributary to it (20681-S04, the Dube Well). In addition, its registered water sources are within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

Pilgrim Foods has four registered water sources; the Town of Greenville water supply system (20681-S01), the Souhegan River Well (20681-S02) and two on-site wells (20681-S03 and 20681-S04). The Town of Greenville water system has been used by Pilgrim Foods since it started reporting its water use in 1999 and remains its principal source of water. The Souhegan River Well was used along with the water purchased from the Town of Greenville water system until the end of 2006, when the lease that Pilgrim Foods had with the Town for use of the well expired. The two on-site wells were inactive from 1999 through 2008, but Pilgrim Foods started using these wells in 2009 so they could reduce the amount of water they purchase from the Town of Greenville. The production of these wells range from 4 - 8 gallons per minute (gpm) for the Dube Well (20681-S04) to 12 - 15 gpm for the Davis Well (20681-S03). Pilgrim Foods can also store 20,000 gallons of water in on-site storage tanks.

Water use by Pilgrim Foods is daily, Monday through Friday during normal operating hours (7 am to 4 pm). Water use is metered by each source and is checked weekly. The total monthly water use is reported to the Department of Environmental Services (DES) quarterly.

## Water Use Patterns

Water use data for Pilgrim Foods for the years of 1999 through 2008 were obtained from DES and are presented in Figures 1 and 2 and are summarized in Tables 1 and 2. Water use data were available for the period of 1999 through 2008 for the Greenville water supply source and the Souhegan River Well (now inactive); while no water use was reported for the two on-site wells. The monthly water use records are incomplete for 1999 through 2001, with complete monthly records beginning in 2002.

Between 1999 and 2008 annual water use by Pilgrim Foods ranged from a high of 17.2 million gallons (2006) to a low of 2.80 million gallons (2002) and has averaged 12.39 million gallons (Figure 1 and Table 1). During this period, annual water use by Pilgrim Foods has increased by 9.50 million gallons or 140 percent (Figure 1). This represents an increase of 951,200 gallons a year or 14 percent over the ten year period. The increase in water use by Pilgrim Foods directly reflects the increased production at the facility over this time.

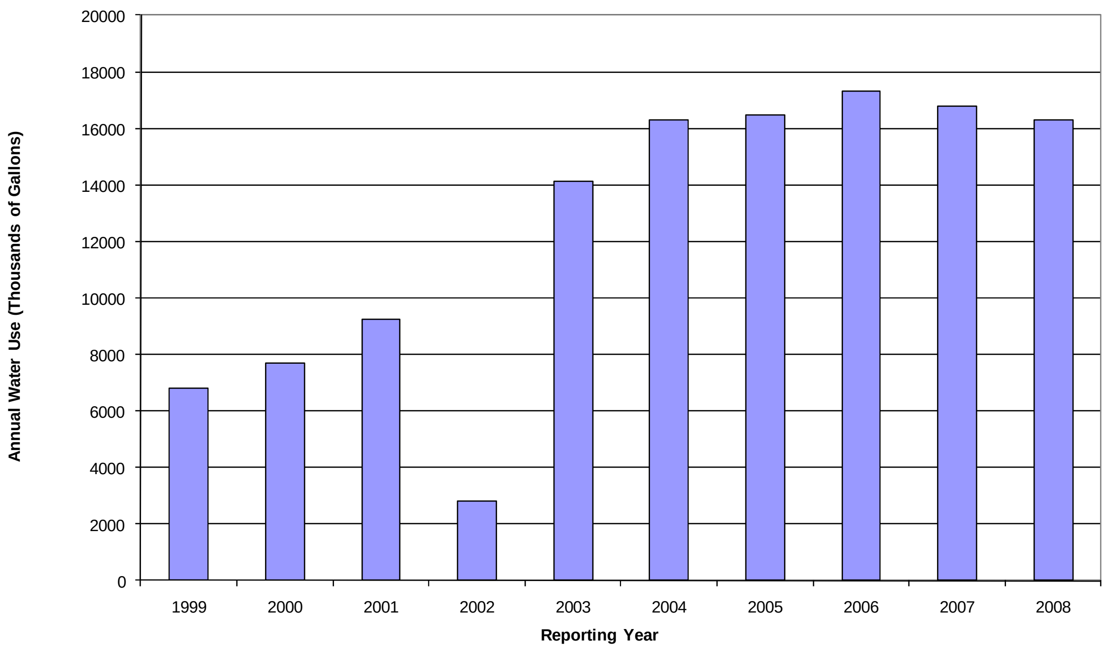


**Figure 1 – Pilgrim Foods, Inc. Annual Water Use 1999 through 2008**

**Table 1 - Annual Water Use Statistics (Combined Sources 1999 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 2,800 | 17,300 | 12,390 |
| **(cfs)** | 0.012 | 0.073 | 0.053 |
| **(cfsm at impact point)** | 0.0004 | 0.0023 | 0.0017 |
| **(cfsm at Merrimack Gage)** | 0.0001 | 0.0004 | 0.0003 |

Between 1999 and 2008 annual water use by Pilgrim Foods ranged from a high of 17.2 million gallons (2006) to a low of 2.80 million gallons (2002) and has averaged 12.39 million gallons (Figure 1 and Table 1). During this period, annual water use by Pilgrim Foods has increased by

9.50 million gallons or 140 percent (Figure 1). This represents an increase of 951,200 gallons a year or 14 percent over the ten year period. The increase in water use by Pilgrim Foods directly reflects the increased production at the facility over this time.

Annual water use by Pilgrim Foods increased steadily from 1999 to 2007, except for the significant drop experienced in 2002 (Figure 1). The dramatic reduction in water use that year is reportedly due to a fire at the facility in December 2001, which significantly impacted their business operations. Since its peak in 2007, annual water use declined slightly in 2008.

The principal source of water for Pilgrim Foods has been the Greenville water supply, which was supplemented by water withdrawn from the Souhegan River Well. The use of the Souhegan River Well peaked in 2003 and 2004 and then quickly declined in 2005 and 2006. At the end of 2006, the lease that Pilgrim Foods had with the Town for the use of this well expired and they discontinued its use. Pilgrim Foods currently plans on using the two on-site wells to replace the water formerly withdrawn from the Souhegan River Well and to reduce the amount of water purchased from the Town.

Over the period of record, average monthly water use has varied over a narrow range (500,000 gallons), while the difference between the maximum and minimum monthly water use has been much larger (Figure 2 and Table 2). The highest total monthly water use was 2.23 million gallons (May 2001), the lowest total monthly water use was 0 (January 2002), with an average monthly use of 1.20 million gallons. Historically, the lowest mean monthly water use occurs from November through February because production is reduced is response to a seasonal decline in the demand for their food products.

The monthly water use data for Pilgrim Foods were converted from thousand gallons per month to cubic feet per second (cfs) by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (64 sq. miles) of the Designated Reach above the impact point of the withdrawals.

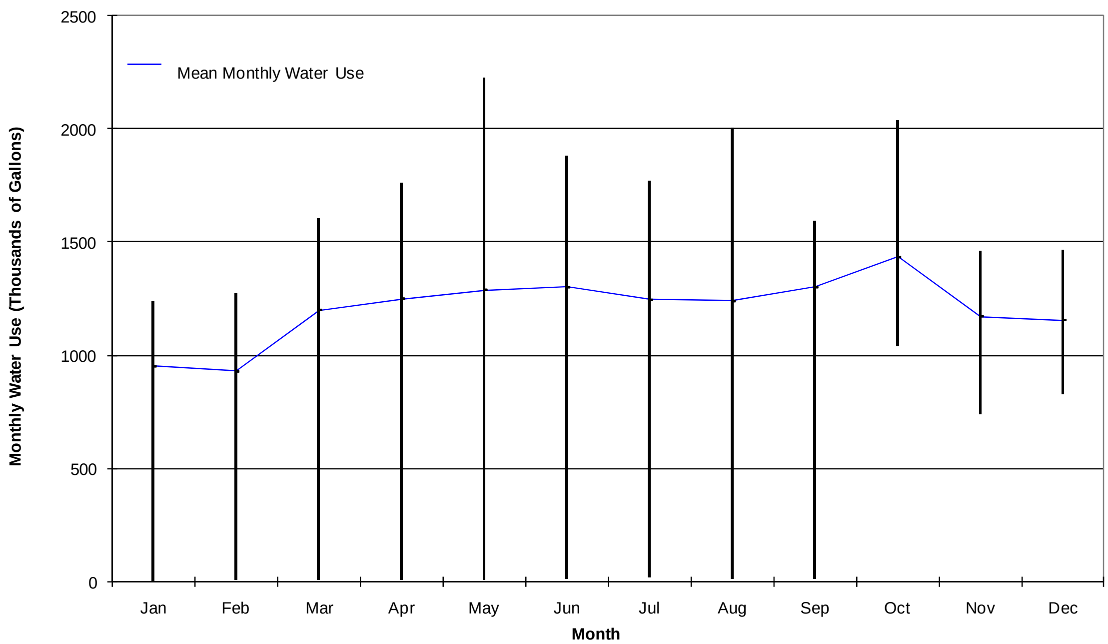


**Figure 2 – Pilgrim Foods, Inc. Monthly Water Use 1999 through 2008**

**Table 2 - Monthly Water Use Statistics (Combined Sources 1999 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 2,225 | 1,200 |
| **(cfs)** | 0.000 | 0.110 | 0.061 |
| **(cfsm at impact point)** | 0.000 | 0.0035 | 0.0019 |
| **(cfsm at Merrimack Gage)** | 0.000 | 0.0007 | 0.0004 |

Based on these values, the average daily water use by Pilgrim Foods has ranged from a minimum of 0.00 cfs (several months of no reported water use) to a maximum of 0.11 cfs (71,742 gallons per day)(May 2001), and average use was 0.006 cfs (39,426 gallons per day) for the period of 1999 to 2008 (Table 2).

**Potential for Water Use Management to Support Protected Instream Flows**

Pilgrim Foods has limited potential to support the Protected Instream Flows on the Souhegan Designated River. Its principal water source is the Town of Greenville, which obtains its water from the Tobey Reservoir. Supplementing this source is groundwater withdrawn from two on-site wells. The Dube Well (20681-S03) is located within 400 feet of the designated river. The well is over 1,000 feet deep, completed in bedrock and pumped at a rate between 4 and 8 gpm. The Davis Well (20681-S04) is located over 500 feet from the designated river, but within 400 feet of a tributary to it. This well is over 600 feet deep, completed in bedrock, sand and gravel and is pumped at a rate between 12 and 15 gpm. Due to their depth and low pumping rates, these wells are not expected to induce recharge from the river or the tributary stream. In addition, the wastewater produced by the facility is initially treated on site and then discharged into the Town of Greenville's sewer system. This wastewater is further treated at the Town of Greenville wastewater treatment facility and then discharged to the Souhegan Designated River upstream of the Pilgrim Foods facility.

### Water Use Plan Activity

Since the pumping of groundwater at Pilgrim Foods site is not expected to directly impact the Souhegan Designated River or its tributary stream, no Water Use Plan actions are required at this time.

### Estimated Water Use Plan Implementation Costs

Since no water use management actions are currently required for Pilgrim Foods, there are no costs associated with the implementation of the plan.

### Water Use Plan Implementation Schedule

Since no Water Use Plan actions are currently required for Pilgrim Foods, there is no implementation schedule.

### Water User Contact Information

**Water User**: Pilgrim Foods, Inc.
**Address**: 68 Old Wilton Road, Greenville, NH 03048-3100
**Contac**t: Charles Santich
**Phone**: 878-2100
**Email**: charlies@pilgrimfoods.net

### Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Personal communication with Charles Santich, Pilgrim Foods.

Personal communication with Ingrid Sweeney, Pilgrim Foods.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc.

Water use reports on file with the Department of Environmental Services (DES).

## WATER USE PLAN

## Pine Valley Dam (#20782)

### Introduction

The following individual Water Use Plan (WUP) has been prepared for Pine Valley Dam, which is located on the Souhegan River in Milford, New Hampshire. This WUP was prepared using information provided by Milford Elm Street Trust and from their water use records reported to the Department of Environmental Services (DES). The dam is a privately owned hydropower facility that is licensed by the Federal Energy Regulatory Commission (FERC Project No. 9282) and registered with the Department of Environmental Services (DES) Dam Bureau (#254.01).

Under the Instream Flow Rules (Chapter Env-Wq 1900), Pine Valley Dam is considered an Affected Water User (AWU) because its registered water source is within 500 ft of the Souhegan Designated River. In addition, the dam is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Under Chapter Env-Wq 1900, individual WUPs are to be prepared for each AWU located within the Souhegan River WMPA. Each individual WUP is to include:

- Water use data and information to define water use patterns and needs for each AWU,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs,
- An estimate of implementation costs of the plan for each AWU, and
- An implementation schedule for the individual WUP.

### Water Source and Uses

The source of water for the hydropower operations at Pine Valley Dam is the main stem of the Souhegan River and the impoundment formed upstream of the dam. The dam is operated as run-of-river, meaning that the operation of the dam does not alter the flow of the river and that all of the water diverted through the hydroelectric operations is returned to the river. The return point (#20782-D01) is located approximately 0.6 miles downstream of the dam at a former mill building between Wilton Road and North River Road located in Milford, New Hampshire.

The hydroelectric operations use water 24 hours per day, year round. The only flow restrictions on the facility are a FERC permitted minimum instream flow of 25 cfs along with a minimum production flow of 15 cfs for a total minimum flow restriction of 40 cfs. When electricity is not being produced by the facility, flow either goes over the dam and/or through the bypass pipe on the north side of the dam, but not through the penstock.

### Water Use Patterns

Water use data for the Pine Valley Dam for the period of 2004 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 as well as in Tables 1 and 2. Water use records for 2004 were incomplete, so they are not included in the annual use summaries.

Water use by Pine Valley Dam is dependent on river flow. Between 2005 and 2008 annual by Pine Valley Dam ranged from a high of 21,400 million gallons (2006) to a low of 11,500 million gallons (2007), and average use was 18,200 million gallons for the four years that a complete record was available ((Figure 1 and Table 1). During this period, annual water use has not shown significant upward or downward trends.

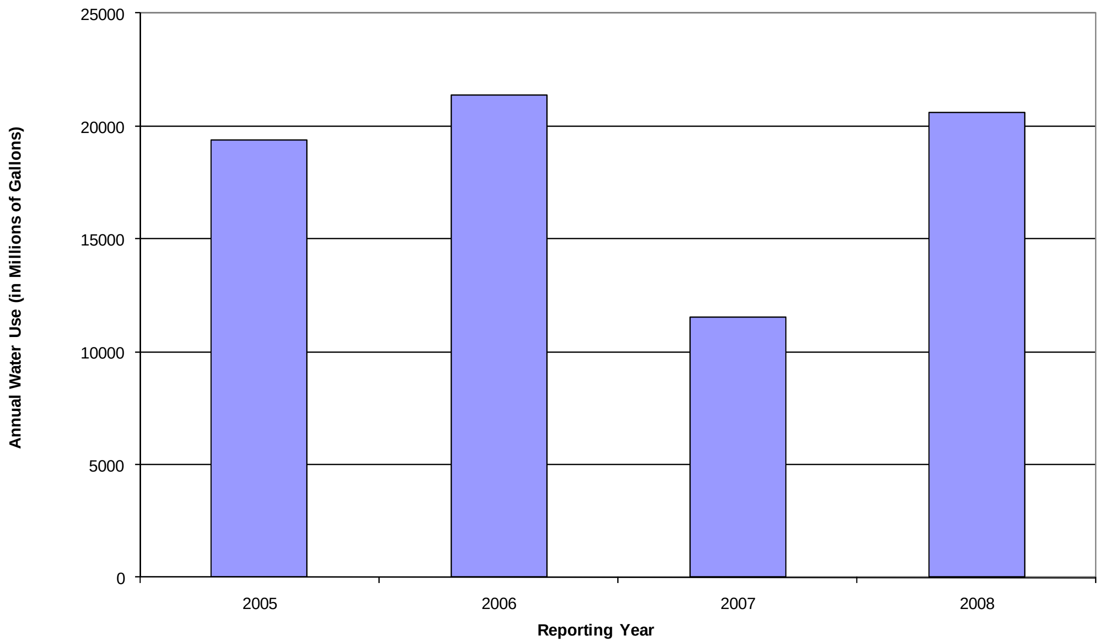


**Figure 1 – Pine Valley Dam Annual Water Use 2005 through 2008**

**Table 1 – Pine Valley Dam Annual Water Use Statistics (2005-2008)**

| | Low | High | Average |
|---|---|---|---|
| (million gal) | 11,500 | 21,400 | 18,200 |
| (cfs) | 48.9 | 90.8 | 77.3 |
| (cfsm at impact point) | 0.482 | 0.895 | 0.762 |
| (cfsm at Merrimack Gage) | 0.286 | 0.531 | 0.452 |

The minimum monthly water use at Pine Valley Dam during this period was 0 gallons (July, 2007; August, 2005; September 2006) with a maximum of 3,360 million gallons (January, 2006) and an average of 1,500 million gallons (Figure 4 and Table 2). The four years of reported data show monthly water use to be quite variable and typically follows the normal river flow. Peak usage occurs during April (2,580 million gallons) and minimum usage occurs during August (195 million gallons), which is typical of a run-of-river hydroelectric dam in New Hampshire.

The monthly use data, in thousands of gallons, were then converted to cubic feet per second. Daily water use by the Pine Valley Dam has ranged from a minimum of 0 cfs (July 2007, August 2005 and September 2006) to a maximum of 168.0 cfs (108.6 million gallons per day, January

2006), and average use was 76.6 cfs (49.5 million gallons per day) for the period of 2004 to 2008.

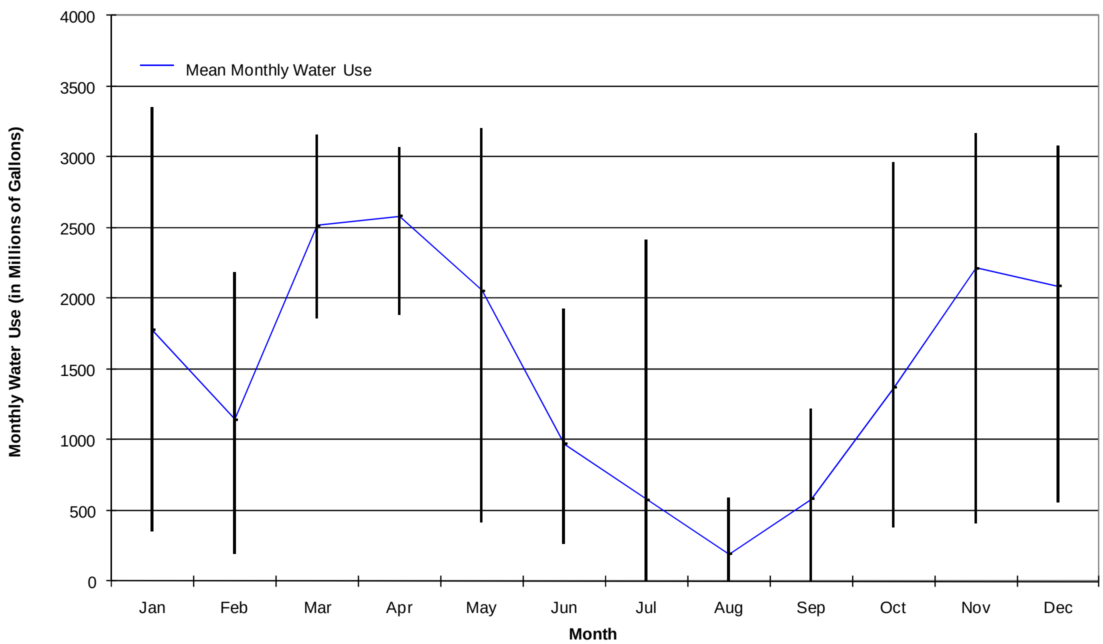


**Figure 2 – Pine Valley Dam Monthly Water Use 2005 through 2008**

**Table 2 - Monthly Water Use Statistics (2004-2008)**

| | Low | High | Average |
|---|---|---|---|
| (million gal) | 0 | 3,360 | 1,500 |
| (cfs) | 0 | 168.0 | 76.6 |
| (cfsm at impact point) | 0 | 1.650 | 0.755 |
| (cfsm at Merrimack Gage) | 0 | 0.980 | 0.448 |

**Potential for Water Use Management to Support Protected Instream Flows**

Pine Valley Dam has limited potential to manage its water use to support the Protected Instream Flows because it is operated on a run-of-river basis and it's already required to support minimum flows in the Souhegan Designated River as a condition of its FERC operating license. The dam is operated on a run-of-river basis and storage in the impoundment upstream of the dam is not actively managed to produce hydroelectricity. So the water use of the dam reflects the discharge of the river, which is greatest during the spring and then declines and flattens during the summer.

Under the terms of its FERC operating license the facility must allow for a minimum outflow of 25 cfs and the facility does not produce power when flows are less than 40 cfs. At flows below 40 cfs no water is diverted to the penstock and all water flows over the dam or through the bypass pipe at the dam.  This minimum flow of 40 cfs is greater than both the Critical and Rare protected instream flows established for the GRAF Spawning and the Rearing & Growth) bioperiods, which are during the summer (June through September).

**Water Use Plan Activity**

Since Pine Valley Dam is operated on a run-of-river basis, and is required to maintain minimum flows in the Souhegan Designated River, the only water use management action to be taken to support the protected instream flows is to pass relief flows un-attenuated (with no diversion to the penstock) from the dams located upstream during a water management action event.  The DES Instream Flow Program will notify the dam owner 24 hours in advance of any relief flow releases from the upstream dams.

**Estimated Water Use Plan Implementation Costs**

Since the water use management action for Pine Valley Dam is to allow any relief flows to pass un-attenuated, there is no direct cost associated with the implementation of the plan.

**Water Use Plan Implementation Schedule**

By June 1, 2014, Pine Valley Dam will implement its Water Use Plan and will institute the measures required to support the protected instream flows.

**Water User Contact Information**

**Water User**: Pine Valley Business Center
**Address**: 37 Wilton Road, Milford, NH, 03055
**Contact**: Lisa Morrison
**Phone**: 880-6655
**Email**: Not available

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

New Hampshire Dam Bureau, NHDAMS Data Sheet for Pine Valley Hydro Mill Dam.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc and completed by Paul Robichaud of Milford Elm Street Trust.

Water use reports on file with the Department of Environmental Services (DES).

**WATER USE PLAN**

**Savage Municipal Water Supply Superfund Site (#20833)**

## Introduction

The following individual Water Use Plan (WUP) has been prepared for Savage Municipal Water Supply Well Superfund Site (Savage Well site), which is located in Milford, New Hampshire. This WUP was prepared using information from the Savage Well water use registration and water use data reported to the Department of Environmental Services (DES).
There are two remediation areas (OU1 – also referred to as the OK Tool site, discussed separately, and OU2 – the Savage Well site) at the site with active groundwater pump and treatment systems. Treated groundwater from the contaminated areas is re-infiltrated to the aquifer via underground injection or is discharged directly into the Souhegan River

Under the Instream Flow Rules (Chapter Env-Wq 1900), the Savage Well site is considered an Affected Water User (AWU) because its registered water source is within 500 ft of the Souhegan Designated River. In addition, its registered water source is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

The Savage Well site covers the groundwater contamination plumes in the Souhegan River aquifer between the OK Tool Source Area (#20832) and the Souhegan River. Groundwater is extracted from a wellfield (20833-S01) that consists of three wells in the plume area. The water is treated for volatile organic compounds (VOCs) via air stripping and returned to the aquifer up-gradient of the extraction wells through a wellfield (20833-D01) that consists of three injection wells. During times of high groundwater levels treated water is also discharged directly to the Souhegan River via a surface water discharge (20833-D02).

## Water Use Patterns

Water use is nearly continuous during treatment operations and the wells are generally pumped at a uniform rate (25 gallons per minute or gpm). Groundwater pumping is metered and is recorded monthly, as well as reported to the DES.

According to the water use registration forms on file with the DES, the extraction wells are typically pumped at a constant rate of 648,000 gallons per day (gpd) with an average annual use of 236,520,000 gallons. The water pumped from the extraction wells is either returned to the aquifer through underground injection or discharged directly into the Souhegan River, thus, there is no net water consumption at this site.

Water use data for the Savage Well wellfield for 2008 were obtained from the DES and are summarized in Figure 1 and Table 1. Since only a partial record of water use is available, only monthly data are presented. From April to December 2008 the highest total monthly water use was 18.4 million gallons (December), the lowest total monthly water use was 7.3 million gallons (November), with an average monthly use of 13.3 million gallons.

The monthly water use data were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (104 sq. miles) of the Designated Reach above the impact point of the withdrawal.

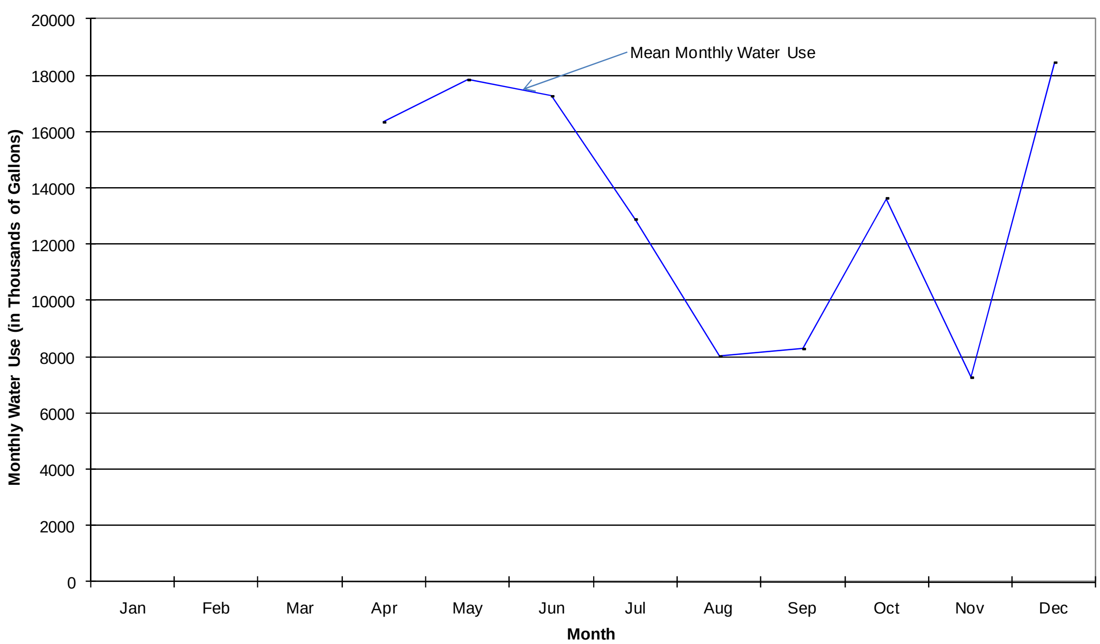


**Figure 1 – Savage Well Site Monthly Water Use for 2008**

Based on these values, the average daily water use for the Savage Well wellfield has ranged from a minimum of 0.37 cfs (239,138 gallons per day, November) to a maximum of 0.92 cfs (594,614 gallons per day, December), and average use was 0.68 cfs (439,498 gallons per day) for 2008 (Table 1).

**Table 1 – Savage Well Site Monthly Water Use Statistics for 2008**

| | Low | High | Average |
|---|---|---|---|
| (thousand gal) | 7,300 | 18,400 | 13,300 |
| (cfs) | 0.3746 | 0.9210 | 0.6750 |
| (cfsm at impact point) | 0.0036 | 0.0088 | 0.0065 |
| (cfsm at Merrimack Gage) | 0.0022 | 0.0054 | 0.0039 |

## Potential for Water Use Management to Support Protected Instream Flows

The Savage Well site has limited potential to support the Protected Instream Flows due to the direct recharge of the treated groundwater back into the Souhegan River and the seasonal discharge of treated groundwater directly into the Souhegan Designated River via a surface discharge on site.

## Water Use Plan Activity

Since the groundwater withdrawn from the Savage Well site is effectively recycled, or discharged to the river during periods of high groundwater levels thereby limiting the potential for water use management, no Water Use Plan actions are currently required for the site.

## Estimated Water Use Plan Implementation Costs

Since no water use management actions are currently required for the Savage Well Site, there are no costs associated with the implementation of the plan.

## Water Use Plan Implementation Schedule

Since no Water Use Plan actions are currently required for the Savage Well site, there is no implementation schedule.

## Water User Contact Information

**Water User**: Hitchner Manufacturing Co. Inc. & Thomas & Betts Corp.
**Address**: McLane, Graf, Raulerson & Middleton, PA, Suite 500, 11 South Main Street, Concord, NH, 03301
**Contact**: Greg Smith
**Phone**: 230-4401
**Email**: gsmith@mclane.com

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
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| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Water use registration forms on file with the Department of Environmental Services (DES).

Waste Site Cleanup & Reuse in New England – Savage Municipal Water Supply, United States Environmental Protection Agency. website: http://yosemite.epa.gov/r1/npl_pad.nsf/701b6886f189ceae85256bd20014e93d/83c7d221bb30028c8525691f0063f6f4!OpenDocument

**WATER USE PLAN**

**Souhegan Woods Golf Club (#20523)**

## Introduction

The following individual Water Use Plan (WUP) has been prepared for the Souhegan Woods Golf Club, which is located off of Thornton Ferry Road in Amherst, New Hampshire. This WUP was prepared using information provided by the Souhegan Woods Golf Club and from their water use records reported to the Department of Environmental Services (DES). This 18-hole golf course was built in 1991 and is open to the public. This facility uses water withdrawn from the Souhegan Designated River for the irrigation of its golf course.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Souhegan Woods Golf Club is considered an Affected Water User (AWU) because its registered water source is within 500 ft of the Souhegan Designated River and its registered water source is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

The Souhegan Woods Golf Club has a registered withdrawal from the Souhegan Designated River (20523-S01), which is the source of irrigation water for the facility. Water is withdrawn from the river via a suction line that extends approximately 15 feet out from the shore and approximately six feet below the water surface.

Water is withdrawn on an “as needed” basis, which is defined as the minimum amount of water necessary to maintain healthy turf as determined through the physical monitoring of soil moisture levels. The water withdrawn from the river by the Souhegan Woods Golf Club is used to irrigate 70 acres of golf course fairways and greens and for equipment cleaning. Irrigation of the courses is necessary to ensure that the various grasses used at the courses remain healthy and adequately watered and to meet user expectations in terms of course appearance, condition and playability.

## Water Use Patterns

Water use is metered, recorded monthly and reported to the DES on an annual basis. A new recording meter was installed in April 2009 and the meters have been checked and calibrated each spring upon start-up.

As noted, water use is on an as needed basis, varying from every day to twice a week, with the greatest use during the spring through the fall, but is also weather dependent. Weather conditions are monitored using information from local weather stations available via the internet. Irrigation is typically performed on a daily basis from 8 pm to 6 am. But, this irrigation schedule can change depending on the results of the soil moisture monitoring performed on the course and in response to any mechanical failures of the irrigation system. If a mechanical failure of the irrigation system occurs during the normally scheduled time, it may be run outside of the 8 pm to 6 am time period. Although, daytime irrigation may not be as efficient as during the night, it requires much less water to maintain adequate soil moisture levels, than it does to recover from inadequate (below normal) soil moisture levels.

Water use data for the Souhegan Woods Golf Club for the years of 1991 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 as well as Tables 1 and 2. The tables include the conversion of the water use from thousands of gallons to cubic feet per second (cfs) and cubic feet per second per square mile of the drainage area to allow for their comparison with streamflow values reported for the Souhegan Designated River.

Between 1991 and 2008 annual water use by Souhegan Woods Golf Club ranged from a high of 56.8 million gallons (2001) to a low of 17.4 million gallons (2003), and average use was 34.9 million gallons (Figure 1 and Table 1). During this period, annual water use increased by 7.27 million gallons or by 27 percent. This represents an increase of 404,000 gallons a year or 1.5 percent per year.

From 1991 to 2001 annual water use increased by 112 percent, but declined from 2001 to 2003 due to changes in water use management to increase water use efficiency. These changes included the introduction of new turf grasses and wetting agents and improvements in their pumping operations. Water use increased again between 2003 and 2008.

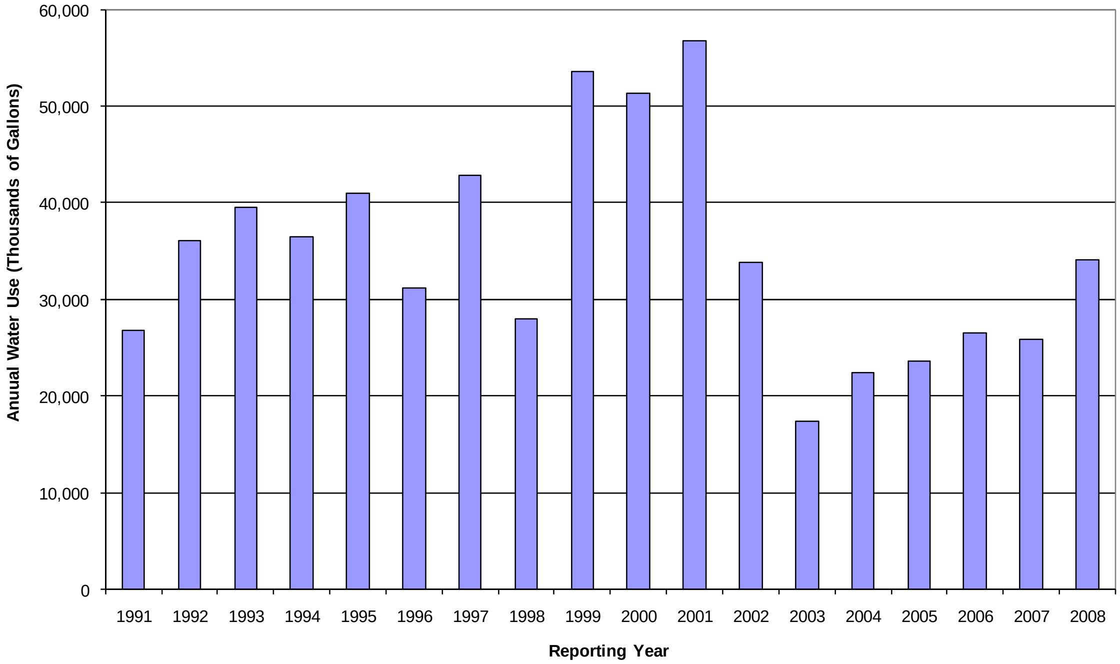


**Figure 1 – Souhegan Woods Golf Club Annual Water Use 1991 through 2008**

**Table 1 – Souhegan Woods Golf Club Annual Water Use Statistics (1991 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 17,400 | 56,800 | 34,900 |
| **(cfs)** | 0.0740 | 0.2410 | 0.1480 |
| **(cfsm at impact point)** | 0.0005 | 0.0015 | 0.0009 |
| **(cfsm at Merrimack Gage)** | 0.0004 | 0.0014 | 0.0009 |

Water withdrawals typically begin in April, but have occasionally occurred in March (six years), increase to a maximum in July, then decline and typically end by November (Figure 4). The range in water use reflects the weather conditions that affect the water demand by the golf course turf. Total monthly water use for the reporting period has ranged from 0 (multiple occurrences) to 16.3 million gallons (August 2001, a period of drought) and averaged 2.89 million gallons per month over the year (Table 2). When averaged for just the April-October period, average monthly water use was 4.93 million gallons.

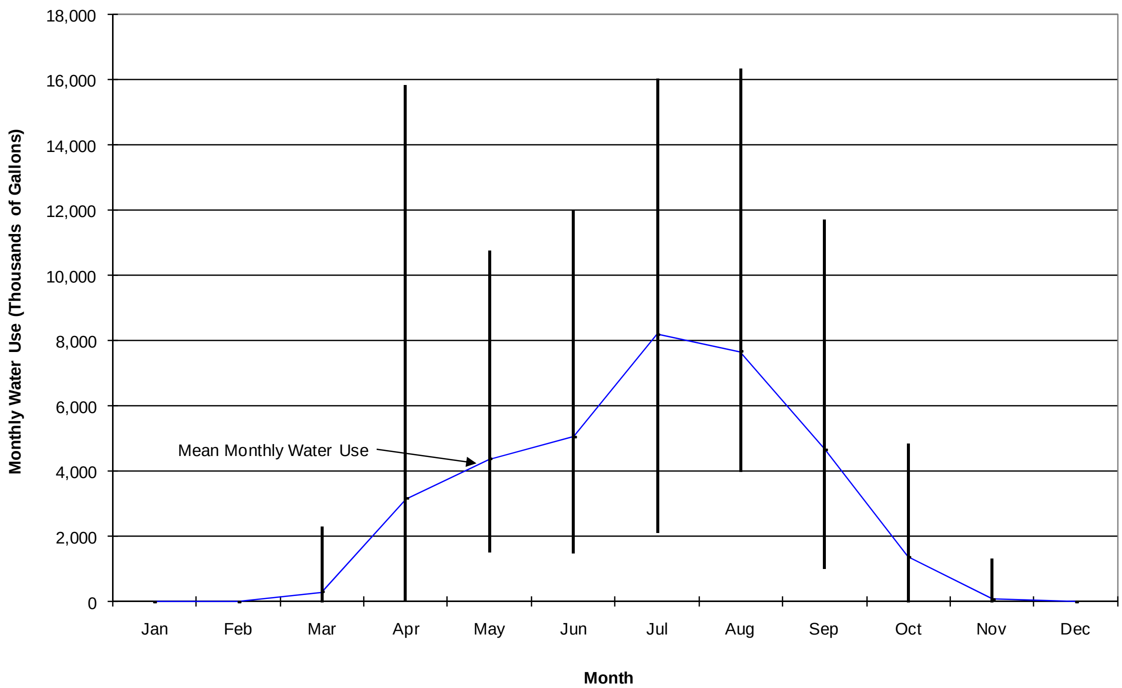


**Figure 2 – Souhegan Woods Golf Club Monthly Water Use 1991 through 2008**

**Table 2 – Souhegan Woods Golf Club Monthly Water Use Statistics (1991 through 2008)**

| | Low | High | Average | Apr-Oct avg |
|---|---|---|---|---|
| **(thousand gal)** | 0 | 16,300 | 2,890 | 4,930 |
| **(cfs)** | 0 | 0.816 | 0.147 | 0.249 |
| **(cfsm at impact point)** | 0 | 0.0051 | 0.0009 | 0.0016 |
| **(cfsm at Merrimack Gage)** | 0 | 0.0048 | 0.0009 | 0.0015 |

The monthly water use data were converted from thousand gallons per month to cubic feet per second (cfs) by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor. These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (159 sq. miles) of the Designated Reach above the impact point of the withdrawal.

Based on these values water use by the Souhegan Woods Golf Club has ranged from a minimum of 0 cfs (December through February in all years, November in all but one year (1999), ten years in March, two years in April and October) to a maximum of 0.816 cfs (527,397 gallons per day, August 2001) with an average of 0.249 cfs (160,934 gallons per day) for the April – October period and 0.147 cfs (95,009 gallons per day) annually during the past 18 years (Table 2).

**Potential for Water Use Management to Support Protected Instream Flows**

Presently, the Souhegan Woods Golf Club is solely dependent upon the direct withdrawal of water from the Souhegan Designated River as its source for irrigation water, and as a result, has limited potential to manage its water use to support the protected instream flows. During those infrequent periods when a reduction in water withdrawals is needed to support the protected instream flows, alternative off-stream sources of water may have to be used. These may include:

- withdrawals from existing ponds on the golf course;
- the development of additional water hazard/storage ponds; and
- the development of a new groundwater supply

There are a total of four small ponds, having a combined surface area of roughly an acre, located on the Souhegan Woods Golf Club course. The exact volume of the ponds is unknown, but there is some potential that these ponds could be used as a temporary source of water for irrigation. This would allow Souhegan Woods Golf Club to reduce their withdrawal of water from the Souhegan Designated River when streamflow falls below the Critical or Rare flow thresholds for a period greater than their catastrophic durations.

The construction of additional water hazards or storage ponds on the Souhegan Woods Golf Club appears to be limited due to the lack of undeveloped land. The potential for expanding the existing water hazards for water storage is also limited due to the impact that they would have on the existing golf course operations.

Another potential alternative off-stream water supply source would be the development of a new groundwater supply. Based on information available from the United States Geological Survey (Toppin 1987), Souhegan Woods Golf Club is located on a stratified-drift aquifer. Production from a new well could be used during periods when streamflow in the river falls below the Critical or Rare flow thresholds for periods greater than their catastrophic durations, thereby replacing or reducing its direct withdrawal from the river.

Each of these alternatives would require additional evaluation to determine their feasibility. Important factors in determining their feasibility would include: the amount of water made available by the development of the alternative; the identification and evaluation of any hydrologic impact to the Souhegan Designated River as a result of the development of the alternative; the cost of each alternative; and permitting requirements.

**Water Use Plan Activity**

The highest mean and total monthly water use by Souhegan Woods Golf Club occurs during the months from June through September, which also coincides with the two bioperiods (GRAF Spawning and Rearing & Growth – June 15 to September 30) that have the lowest protected instream flow values (Critical flow of 26 cfs and Rare flow of 17 cfs, DES 2008). To support the protected instream flows, Souhegan Woods Golf Club will reduce its direct withdrawal of water from the Souhegan Designated River to the *de minimis* amount when mean daily discharge, as measured at the USGS gaging station (01094000) in Merrimack, falls below the Critical flow threshold of 26 cfs for a period exceeding its Catastrophic duration of 20 days or when the mean daily discharge falls below the Rare threshold of 17 cfs, prior to this. Mean daily discharge at the USGS gaging station and the protected instream flow conditions will be tracked by DES and will be available at its web page:

http://www2.des.state.nh.us/OneStopPub/Watershed/souhegan-lower-pisf-track.xls

Under Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, the *de minimis* amount of water shall always be available for use: where the *de minimis* amount is defined as being "equal to 5 percent of 7Q10 at that location" (Env-Wq 1902.07). 7Q10 means the lowest average flow rate for a period of 7 consecutive days on an annual basis with an expected recurrence interval of once in every 10 years (Env-Wq 1902.01). Based on the discharge records for the USGS gaging station (01094000) in Merrimack, the 7Q10 for the Souhegan Designated River is 12.9 cfs, so the *de minimis* amount (5 percent) is equal to 0.65 cfs or 416,876 gallons per day. This *de minimis* amount of water is to be shared equally among those withdrawing water under this condition; the Amherst Country Club/Ponemah Green Family Golf Center, Souhegan Woods Golf Club, and Mr. de Bruyn Kops.

Since there are two other direct withdrawals on the Souhegan Designated River, the portion available to Souhegan Woods Golf Club is 0.22 cfs or 142,190 gallons per day. While the *de minimis* amount is slightly higher than the historical average monthly water use (in cfs) by Souhegan Woods Golf Club (Table 2) it is less than the average water use during the months of June through September. This suggests that more stringent water conservation measures would need to be implemented as a management action by Souhegan Woods Golf Club to reduce water demand or that an alternative source(s) of water would need to be used to supplement the water withdrawn from the river.

The reduction in the direct withdrawal of water from the Souhegan Designated River will be rescinded when daily mean discharge, as measured at the USGS gaging station (01094000) near Merrimack exceeds 26 cfs, from a natural recharge event, for two consecutive days.

**Estimated Water Use Plan Implementation Costs**

During periods of reduced withdrawals from the Souhegan Designated River, Souhegan Woods Golf Club would need to either reduce their irrigation operations by taking additional conservation measures or supplement the withdrawal of water from new on-site storage ponds or from a new groundwater supply well. The development of a new groundwater supply well has several potential advantages over new on-site storage ponds, the most important being that it would provide a larger and more continuous source of water for irrigation. The estimated cost for the exploration, permitting and development of a new well is dependent on the site specific conditions, but this cost could exceed $100,000.

**Water Use Plan Implementation Schedule**

By June 1, 2014, Souhegan Woods Golf Club will implement its Water Use Plan and will institute the measures required to support the protected instream flows on the Souhegan

Designated River during the GRAF Spawning and Rearing & Growth bioperiods from June 15 to September 30.

**Water User Contact Information**


**Water User**: Souhegan Woods Golf Club
**Address**: 65 Thorton Ferry Road II, Amherst, NH, 03031
**Contac**t: Ryan Lane, Superintendent
**Phone**: 424-4122
**Email**: rustyone33@yahoo.com


**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc.

Personal communication with Ryan Lane, Souhegan Woods Golf Club.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed by Ryan Lane, Souhegan Woods Golf Club.

Toppin, K.W. 1987. Hydrogeology of Stratified-Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area. South-Central New Hampshire. United States Geological Survey Water-Resources Investigations Report 86-4358. Prepared in cooperation with the Nashua Regional Planning Commission and the New Hampshire Water Resources Board.

Water use reports on file with the Department of Environmental Services (DES).

# WATER USE PLAN

## Waterloom Falls Dam (#20228)

### Introduction

The following individual Water Use Plan (WUP) has been prepared for Waterloom Falls Dam, which is located on the Souhegan River in New Ipswich, New Hampshire. The following WUP was prepared using information provided by Alden Engineering and from their water use records reported to the Department of Environmental Services (DES). The dam is a privately owned hydropower facility that is licensed by the Federal Energy Regulatory Commission (FERC Project No. 7920) and registered with the DES (DES) Dam Bureau (#175.09).

Under the Instream Flow Rules (Chapter Env-Wq 1900), Waterloom Falls Dam is considered an Affected Water User (AWU) because its registered water source is within 500 ft of the Souhegan Designated River. In addition, the dam is within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

### Water Source and Uses

The source of water for the hydropower operations at Waterloom Falls Dam is the main stem of the Souhegan River and Waterloom Pond, the impoundment formed upstream of the dam. The dam is operated as run-of-river, meaning that the operation of the dam does not alter the flow of the river and that all of the water diverted through the hydroelectric operations is returned to the river.

If sufficient flow is available, the hydroelectric operations at Waterloom Falls Dam can produce power 24 hours a day, seven days a week, 365 days a year. Under the terms of its license to operate the facility, it must allow for a minimum outflow of 10 cubic feet per second (cfs) during the summer (June through September) and 15 cfs during the winter. When the hydropower facility is not operating all of the flow goes over the dam’s spillway.

### Water Use Patterns

Water use data for the Waterloom Falls Dam for the period of 1989 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 as well as in Tables 1 and 2. Monthly water use records begin in January 1989 and are complete except for the years 1999 and 2007 when no water use data were reported.

Water use by Waterloom Falls Dam is dependent on river flow.  Between 1989 and 2008 annual water use by Waterloom Falls Dam ranged from a high of 6,680 million gallons (1996) to a low of 2,760 million gallons (2001), and average use was 4,890 million gallons for the 18 years that a complete annual record was available (Figure 1 and Table 1).  Annual water use has not shown significant upward or downward trends and has mirrored water usage at other Souhegan River dams.

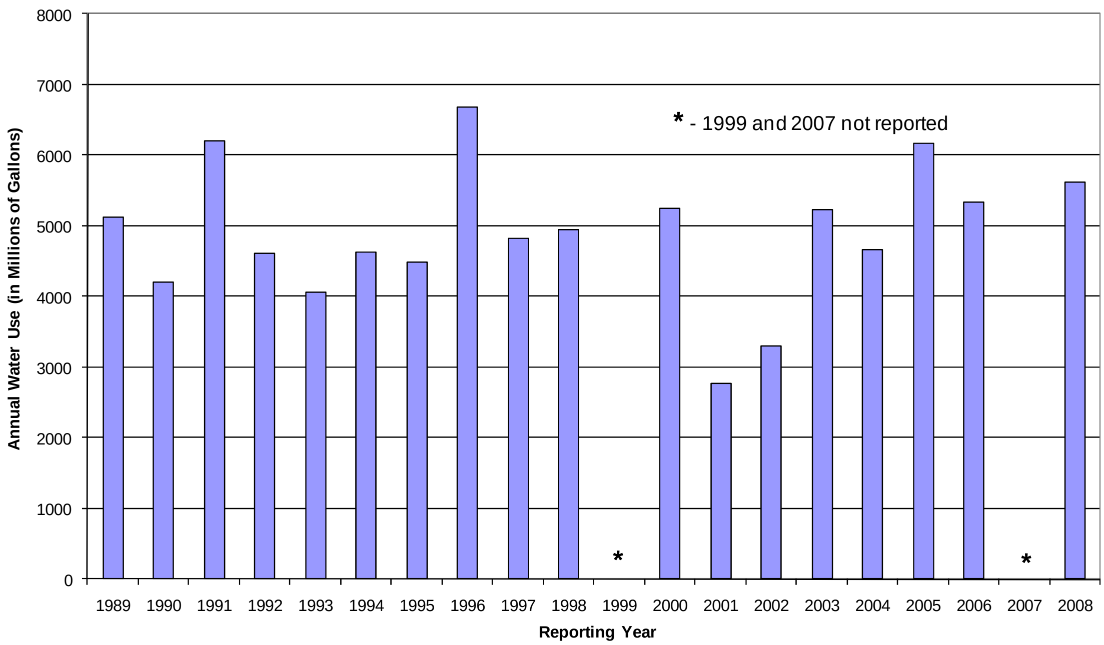


**Figure 1 – Waterloom Falls Dam Annual Water Use 1989 through 2008**

**Table 1 – Waterloom Falls Dam Annual Water Use Statistics (1989 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 2,760 | 6,680 | 4,890 |
| **(cfs)** | 11.70 | 28.30 | 20.80 |
| **(cfsm at impact point)** | 0.5180 | 1.2500 | 0.9170 |
| **(cfsm at Merrimack Gage)** | 0.0686 | 0.1660 | 0.1210 |

The monthly water use records for Waterloom Falls Dam begin in January 1989.  The total and average monthly water use was highest during the spring (March through May) which coincides with the seasonal period of high streamflow, while the lowest total and average monthly water use occurs during the summer (July through September), when flows on the river are typically lowest (Figure 2).  The highest total monthly water use was 951 million gallons (April 2008), the lowest total monthly use was 416,000 gallons (July through September 1990), with an average monthly use of 408 million gallons (Figure 2 and Table 2).

The monthly use data for Waterloom Falls Dam were converted from thousands of gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor.  These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (23 sq. miles) of the Designated Reach above the impact point of the withdrawal.

Based on these converted values, daily water use by the Waterloom Falls Dam has ranged from a minimum of 0.02 cfs (12,926 gallons per day, July and August, 1990) to a maximum of 49.10 cfs (31.7 million gallons per day in April 2008), and average use was 20.80 cfs (13.4 million gallons per day) for the period of 1989 to 2008 (Table 2).

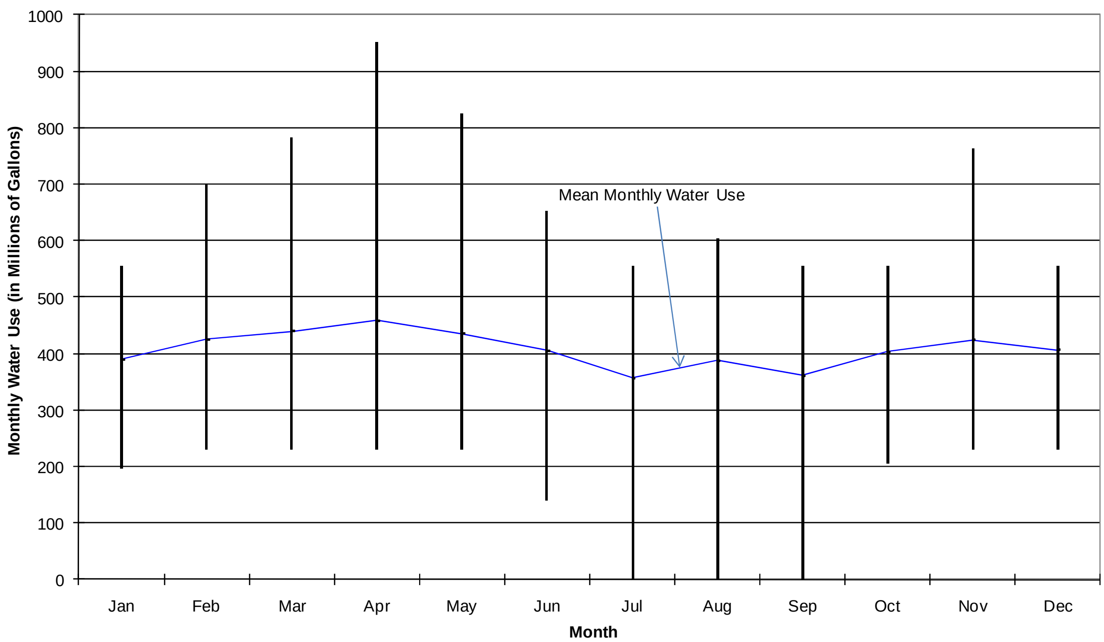


**Figure 2 – Waterloom Falls Dam Monthly Water Use 1989 through 2008**

**Table 2 – Waterloom Falls Dam Monthly Water Use Statistics (1989 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(million gal)** | 0.416 | 951 | 408 |
| **(cfs)** | 0.02 | 49.10 | 20.80 |
| **(cfsm at impact point)** | 0.0009 | 2.1700 | 0.9170 |
| **(cfsm at Merrimack Gage)** | 0.0001 | 0.2870 | 0.1210 |

## Potential for Water Use Management to Support Protected Instream Flows

Waterloom Falls Dam has limited potential to manage its water use to support the protected instream flows because it is operated on a run-of-river basis and it's already required to support minimum flows in the Souhegan Designated River as a condition of its FERC operating license. The water use of the dam largely reflects the discharge of the river.

## Water Use Activity

Since Waterloom Falls Dam operated on a run-of-river basis, and is required to maintain minimum flows in the Souhegan Designated River, the only water use management action to be taken to support the protected instream flows is to pass relief flows un-attenuated from the dams located upstream during a water management action event.

## Estimated Water Use Plan Implementation Costs

Since the water use management action for Waterloom Falls Dam is to allow any relief flow to pass un-attenuated, there is no direct cost associated with the implementation of the plan.

## Water Use Plan Implementation Schedule

By June 1, 2014, Waterloom Falls Dam will implement its Water Use Plan and will institute the measures required to support the protected instream flows.

## Water User Contact Information

**Water User**: Alden Hydro LLC
**Address**: 69 Spring Hill Road, Sharon, NH 03458
**Contac**t: Robert Greenwood
**Phone**: 924-5777
**Email**: greenwoodandson@aol.com

## Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) Dam Bureau, NHDAMS Data Sheet for Waterloom Falls Dam.

Personal communication with Robert Greenwood, Alden Hydro LLC.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. and completed with input from Robert Greenwood of Alden Engineering.

Water use reports on file with the Department of Environmental Services (DES).

**WATER USE PLAN**

**Wilton Water Works (#20065)**

## Introduction

The following individual Water Use Plan (WUP) has been prepared for Wilton Water Works, which supplies water for the Town of Wilton, New Hampshire. This WUP was prepared using information provided by Wilton Water Works and from their water use records reported to the Department of Environmental Services (DES). Wilton Water Works has two registered water sources that are located between Route 31 and the Souhegan Designated River, in the south-central portion of the Town.

Under the Instream Flow Rules (Chapter Env-Wq 1900), Wilton Water Works is considered an Affected Water User (AWU) because its registered water sources are within 500 ft of the Souhegan Designated River and its registered water sources are within the Souhegan River Water Management Planning Area (WMPA), which is the watershed area of the Souhegan Designated River. Chapter Env-Wq 1900 requires the preparation of water use plans for each AWU located within the Planning Area, and must include:

- Water use data and information to define water use patterns and needs;,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs;
- An estimate of implementation costs of the plan; and
- An implementation schedule.

## Water Source and Uses

The Wilton Water Works supply source consists of two registered groundwater wells, the Everett Well (20065-S01) and the Abbott Well (20065-S02). These gravel-packed wells are located 849 and 97 feet west of the Souhegan Designated River. These two ground water wells are the current water supply sources for residents and businesses in the Town.

The wells are located in a stratified drift formation connected to the Souhegan River and intercept groundwater flowing to the river. An analysis of induced recharge by these wells was performed as part of the Instream Flow Study (DES 2005). These results of the analysis indicated that the wells do not induce river recharge at normal and maximum pumping levels. A more detailed hydrogeologic assessment of the production wells has since been performed by Emery & Garrett Groundwater, Inc. (2008) for the Wilton Water Commission. The objective of the study was to delineate the wellhead protection area around the wells. Based in the study's findings, Emery & Garrett Groundwater, Inc. (2008) concluded that approximately 32 percent of the groundwater being withdrawn from the Abbott Well was induced from the Souhegan River, while there was no evidence that the Everett Well induced recharge from the river.

**Water Use Patterns**

Water withdrawal for the Town's water supply needs is continuous and pumping alternates between the two wells to reduce drawdown in the aquifer. The active well is pumped 6 to 8 hours and then shut down for 16 to 18 hours. When system demand exceeds the present pumping rate of the active well, the second well automatically comes on line. The pre-set flow rate for the Abbott Well is 400 gallons per minute (gpm), while the Everett Well pumping rate is pre-set at 450 gpm. Daily water demand varies diurnally with the highest demand during the day and the lowest demand at night. When pumping exceeds demand, excess water fills storage (one tank of 616,000 gallons), and when pumping is less than demand, stored water makes-up the difference. Both wells are metered and withdrawals are recorded monthly and reported to DES quarterly.

Water use data for the Wilton Water Works for the years of 1988 through 2008 were obtained from the DES and are summarized in Figures 1 and 2 as well as in Tables 1 and 2. Water use records were incomplete for 1988, so they are not included in the annual use summaries. The monthly summaries include both complete and incomplete records for the years 1988 through 2008.

Between 1989 and 2008 annual water use by Wilton Water Works ranged from a high of 115.2 million gallons (1990) to a low of 61.6 million gallons (2002), and average use was 81.2 million gallons (Figure 1 and Table 1). During this period, annual water use has decreased by 21.4 million gallons or 23 percent. This represents a decrease of 1.07 million gallons a year or 1.2 percent per year over the 20 year period. The decline in water use after 1995 is most likely the result of the metering of all of the water users in the Town during that year. Prior to the installation of water meters, water users only paid a flat base fee.

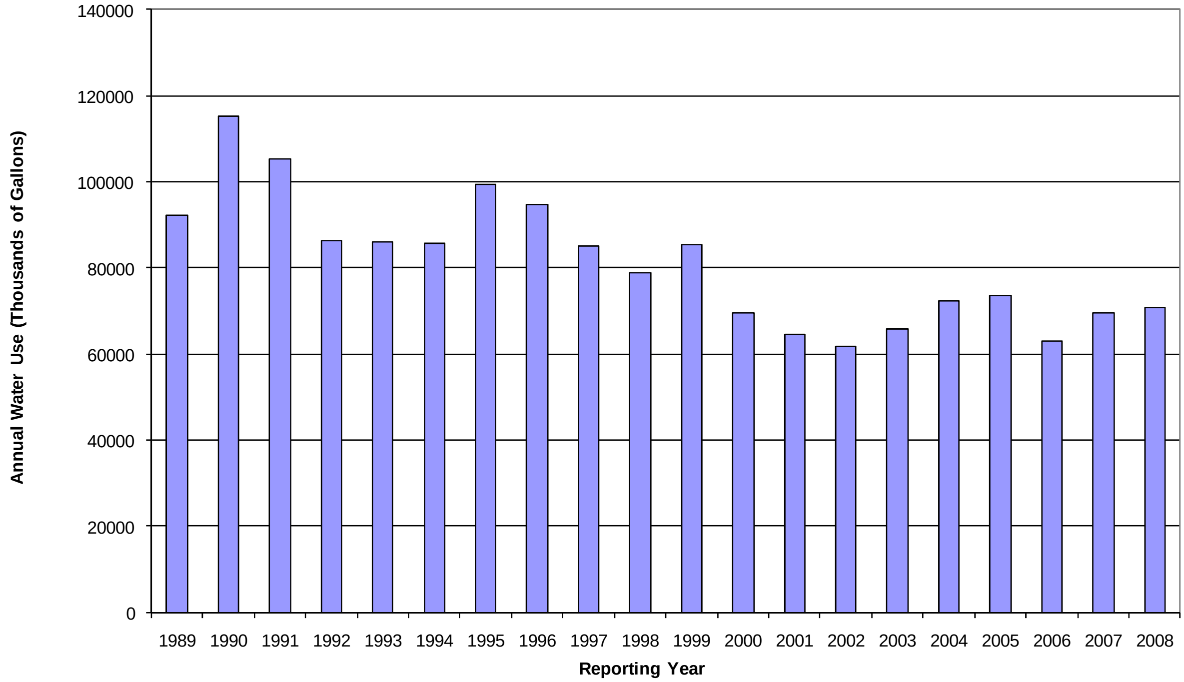


**Figure 1 – Wilton Water Works Annual Water Use 1989 through 2008**

**Table 1 – Wilton Water Works Annual Water Use Statistics (1989 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 61,650 | 115,200 | 81,200 |
| **(cfs)** | 0.0262 | 0.4889 | 0.3446 |
| **(cfsm at impact point)** | 0.0056 | 0.0074 | 0.0105 |
| **(cfsm at Merrimack Gage)** | 0.0015 | 0.0029 | 0.0020 |

The monthly water use records for the system begin in October 1988. Monthly water use varies in response to weather conditions and changes in seasonal demand. For the system, the total and average monthly water usage was highest during summer and lowest during winter. This seasonal pattern reflects increased outdoor water usage (lawn irrigation, garden watering, vehicle washing, etc.) during the summer months, which then declines during the fall; remains low during the winter and begins to increase again in the spring. The highest total monthly use was 11.7 million gallons (June 1991), the lowest total monthly use was 0 gallons in December 2008, but this was due to the recording meters being damaged as a result of an ice storm. Otherwise, the lowest total monthly water use was 2.1 million gallons in November 2002. The average monthly use was 6.8 million gallons (Figure 2 and Table 2).

The monthly water use data for Wilton Water Works were converted from thousand gallons per month to cubic feet per second by dividing the monthly totals by days and then multiplying them by a flow unit conversion factor These values were also divided by the drainage basin area (171 sq. miles) relative to the location of the United States Geological Survey gaging station (01094000) on the Souhegan Designated River in Merrimack, New Hampshire and they were also normalized to the drainage area (46.8 sq. miles) of the Designated Reach above the impact point of the withdrawals.

Based on these values, the average daily water use by Wilton Water Works has ranged from a minimum of 0 cfs (0 gallons per day, December 2008) to a maximum of 0.583 cfs (376,805 gallons per day, June 1991), and average use was 0.345 cfs (222,980 gallons per day) for the period of 1988 to 2008 (Table 2).

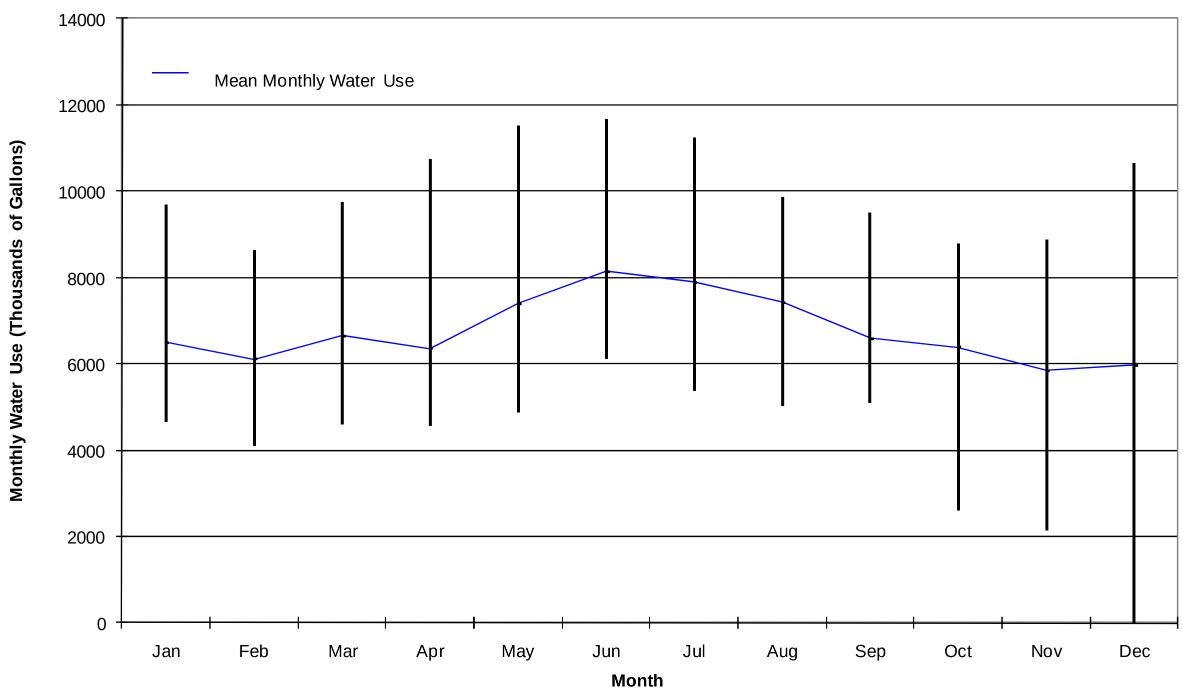


**Figure 2 – Wilton Water Works Monthly Water Use 1988 through 2008**

**Table 2 – Wilton Water Works Monthly Water Use Statistics (1988 through 2008)**

| | Low | High | Average |
|---|---|---|---|
| **(thousand gal)** | 0 | 11,700 | 6,800 |
| **(cfs)** | 0 | 0.5831 | 0.3445 |
| **(cfsm at impact point)** | 0 | 0.0125 | 0.0074 |
| **(cfsm at Merrimack Gage)** | 0 | 0.0034 | 0.0020 |

**Potential for Water Use Management to Support Protected Instream Flows**

The potential for the management of water use by Wilton Water Works to support the protected instream flows on the Souhegan Designated River is high. Wilton's water supply consists of two production wells, only one (Abbott Well) of which has been shown to induce flow from the

Souhegan Designated River. Use of this well should be reduced during the summer and early fall when flows on the Souhegan Designated River fall below the Critical or Rare protected instream flow levels by reducing water demand through the implementation of outdoor water use restrictions.

**Water Use Plan Activity**

Wilton Water Works has an established Emergency Plan Guide (Wilton Water Works 2009) that includes water conservation measures that can be implemented during an emergency or drought. Discussions with public water suppliers indicated an interest and willingness to coordinate reductions in outside water use that is linked with stream flow conditions in order to reduce system demand and support the protected flows.

Outdoor water use reduction will be accomplished by implementing the measures included in the Emergency Plan Guide (Wilton Water Works 2009). Outdoor water use is heaviest during the summer and early fall. The outdoor water use reduction plan will apply to the two bioperiods that correspond with the highest levels of water use, occurring from June 15 to September 30, and when flows in the Souhegan Designated River fall below the Critical and Rate protected instream flow levels (DES 2008). Under this Water Use Plan, outdoor water use will be reduced in three stages: an alert with voluntary water conservation, water use restrictions, and a water use ban.

The prompts for these water use actions are defined by the upper Souhegan Protected Instream Flows (DES 2008) as determined from daily flow measurements at the United States Geological Survey gaging station (01093852) on the Souhegan Designated River near Milford, New Hampshire. The Town will act on its Water Use Plan based on mean daily flow conditions at this gage or based on conditions defined on the DES web page: http://www2.des.state.nh.us/OneStopPub/Watershed/souhegan-upper-pisf-track.xls.

The first action is an alert to its customers and town-wide that voluntary water conservation measures should be taken and that further actions may begin soon. The alert will be enacted by the Town on the day after daily mean discharge at the gage falls below 11 cfs during the GRAF Spawning bioperiod (June 15-July 14) or below 16 cfs during the Rearing and Growth bioperiod (July 15-September 30). The Town will inform its water users through its notification process to implement voluntary water conservation measures and prepare for further actions. An alert may be rescinded when daily mean discharge from a natural recharge event exceeds either 11 or 16 cfs threshold during the appropriate period for two consecutive days.

If daily mean discharge in the Souhegan Designated River continues to decline and fall below the Critical protected flow level of 11 cfs during the GRAF Spawning bioperiod (June 15-July 14) for longer than the 20 day Catastrophic duration or below 16 cfs during the Rearing and Growth bioperiod (July 15-September 30) for longer than the 35 day Catastrophic duration, then the Town will implement their outside water use restrictions described in its Emergency Plan Guide (Wilton Water Works 2009). Restrictions on the watering gardens, lawns, and other landscaped areas; the washing of cars, trucks, RV's, driveways, sidewalks, patios and decks along with the filling of swimming pools from the water system will be imposed. These restrictions may be rescinded when daily mean discharge from a natural recharge event exceeds either the 11 or 16 cfs threshold during the appropriate period for two consecutive days.

If daily mean discharge in the Souhegan Designated River falls below the Rare protected flow level of 8 cfs during the GRAF Spawning bioperiod (June 15-July 14) for longer than the 15 day, Catastrophic duration or below 10 cfs during the Rearing and Growth bioperiod (July 15-September 30) for longer than the 30 day Catastrophic duration, then a ban on outside water use will be imposed, as described in the Emergency Plan Guide (Wilton Water Works 2009). The ban on outside water use may be rescinded or reduced to an earlier restriction level when daily mean discharge from a natural recharge event exceeds either the 8 or 10 cfs threshold during the appropriate period for two consecutive days.

Nothing in this Plan precludes the Town from implementing more restrictive water use actions on its own initiative.

Whenever operational considerations of the water system allow during periods when outdoor water use restrictions are recommended or during a ban on outdoor water use, the Town will manage pumping from its water supply wells to further minimize potential impacts to the Souhegan Designated River. This includes minimizing the withdrawal of groundwater from the well located closest to the river and balancing this reduction with increased pumping from the well farthest from the river and operating the withdrawal at lower withdrawal rates over longer periods of time in preference to higher withdrawal rates for shorter periods.

**Estimated Water Use Plan Implementation Costs**

The water use management actions are the implementation of outside water use reductions or bans when flows on the Souhegan Designated River fall below the Critical or Rare protected instream flow levels during summer and early fall during periods exceeding the catastrophic duration. There are no additional direct costs associated with the implementation of these water use management actions.

**Water Use Plan Implementation Schedule**

By June 1, 2014, the Town of Wilton will implement its Water Use Plan and will institute the measures required to support the protected instream flows on the Souhegan Designated River during the GRAF Spawning and Rearing & Growth bioperiods from June 15 to September 30.

**Water User Contact Information**

**Water User**: Wilton Water Works
**Address**: P.O. Box 83, 42 Main Street, Wilton, NH, 03086
**Contact**: Charles McGettigan, Jr., Water Commissioner
**Phone**: 654-6602
**Email**: Not available

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Sources of Information**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Department of Environmental Services (DES) 2005. Souhegan River Instream Flow Task 2 Report. Prepared by Dr. Tom Ballestero, University of New Hampshire.

Personal communication with Charles McGettigan, Jr., Wilton Water Commission.

Personal communication with Jim Tuttle, Wilton Water Commission.

Emery & Garrett Groundwater, Inc. 2008. Delineation of the Wellhead Protection Area around the Abbott and Everett Production Wells, Wilton, New Hampshire. Prepared for the Wilton Water Commission.

Personal communication with Jim Tuttle, Wilton Water Commission.

Survey of Souhegan River Affected Water Users performed by Normandeau Associates, Inc. completed by Charles McGettigan, Jr. of the Wilton Water Commission.

Wilton Water Works 2009. Emergency Plan Guide. Effective March 2009, Updated July 2009.

Water use reports on file with the Department of Environmental Services (DES).

# Appendix C

# Dam Management Plans

## Souhegan River Water Management Plan

## August 2013

# DAM MANAGEMENT PLAN

## Burton Pond Dam (State Dam ID #147.17)

Figure 1 - Burton Pond Dam spillway, photo taken 1974, from DES Dam Bureau.

### Introduction

Burton Pond Dam (lat. 42$^{o}$ 52' 02", long. -71$^{o}$ 48' 47") is located on a tributary of Stony Brook in Lyndeborough, New Hampshire approximately one half mile north of the Burton Highway. This dam is privately owned (see contact description), it is considered to be active and its designated use is for recreation.  There is no public access to the dam.

### Dam Design

The dam was reportedly built in 1846, and is constructed of earth materials.  The outlet structure is reportedly an uncontrolled spillway (Figure 1).  Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner.  The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

### Minimum Flow, Flowage Rights or Contractual Obligations

None; according to the owner.

**Riparian Property Obligations or Agreements**

None; according to the owner, all bordering land is privately owned.

**Water Quality Requirements or Limits**

None; according to the owner.

**Assessment of Potential Water Availability**

DES Dam Bureau files show the maximum storage volume for the Burton Pond Dam is 350 acre-feet (or ac-ft), while its permanent storage volume is 300 ac-ft, with the difference being 50 ac-ft (2.2 million cu. ft. or 16.3 million gallons). When compared with the other dams being evaluated as part of this study, the potential volume of water available from this dam is moderately high, but the drainage area upstream of the dam is only 0.46 sq. miles, which limits the amount of runoff to the impoundment. Therefore, only a moderate amount of water would be available for flow management.

**Potential Impacts of Storage and Release of Relief Flows**

The shoreline around Burton Pond is undeveloped. So impacts to property from increased storage in the pond or releases from the dam would be limited. No extensive wetlands are mapped within or bordering the pond, so changes in water levels due to the storage or release of water from the dam would have minimal impact.

More importantly, there is a large wetland complex approximately 1,500 ft downstream of the dam and a DES Dam Bureau owned flood control dam (Souhegan River Site #10A) located 1.5 miles downstream. Both the wetland and the flood control dam could reduce the volume of any relief flows released from Burton Pond Dam. Coordination with the DES Dam Bureau would be required to minimize the impoundment of any water released from Burton Pond Dam.

**Potential for Dam Management to Support Instream Flow Requirements**

Although this dam is centrally located in the Souhegan River watershed, several other factors offset its favorable location. These include the private ownership of the dam and the surrounding property, the moderate amount of potential storage volume, the small size of the contributing drainage area and the age and condition of the dam, which has an uncontrolled outlet. In addition, a large wetland complex and a flood storage dam are located downstream of the Burton Pond Dam, which may temporarily impound or reduce the volume of any relief flows. As a result, it is unlikely that this dam could feasibly be managed to meet instream flow needs.

**Dam Management Activity**

No dam management activity is required at this time.

**Schedule for Dam Management Plan Implementation**

Since no dam management plan activity is currently required for Burton Pond Dam, there is no implementation schedule.

**Estimated Cost of the Implementation of the Dam Management Plan**

Since no dam management plan activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**
**Owner**: SNVK LLC
**Address**: 700 Mitchell Bridge Rd Apt 58, Athens GA 30606
**Contact**: Barbara Woodward
**Phone**: 603-654-5351
**Email**: None available

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Burton Pond Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **14** |
| **Freeboard (ft)** | **NA** |
| **Type of spillway controls or outlet works** | **Uncontrolled** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **40** |
| **Drainage area (sq. miles)** | **0.46** |
| **Maximum storage (ac-ft)** | **350** |
| **Normal or permanent storage (ac-ft)** | **300** |
| **Total discharge capacity (cfs)** | **NA** |
| **Maximum unoperated discharge (cfs)** | **75** |
| **Design storm discharge (cfs)** | **NA** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **NA** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #147.17

Note:

NA – not available from NH Dams Data Sheet.

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**DAM MANAGEMENT PLAN**

**Dream Lake Dam (State Dam ID #007.15)**

Figure 1 – Dream Lake Dam outlet, photo taken August 16, 2007.

### Introduction

The Dream Lake Dam (lat. 42$^{o}$ 52’ 09”, long. -71$^{o}$ 36’ 12”) is located on a natural swale in Amherst, New Hampshire and just north of Baboosic Lake Road. This dam is privately owned (see contact information), its status is considered to be active and its designated use is for recreation. There is no public access to the dam.

### Dam Design

The dam was reportedly built in 1966, and it consists of a concrete and earth embankment. The outlet structure is a drop inlet constructed of concrete and stone and has slots for the installation of stoplogs (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

### Minimum Flow, Flowage Rights or Contractual Obligations

None, according to the dam owner.

## Riparian Property Obligations or Agreements

None, according to the dam owner, the surrounding land is privately owned.

## Water Quality Requirements or Limits

None, according to the dam owner.

## Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for the Dream Lake Dam is 36.24 acre-feet (or ac-ft), while its permanent storage volume is 15.44 ac-ft, with the difference being 20.8 ac-ft (906,048 cu. ft. or 6.78 million gallons). When compared with the other dams in the Water Management Plan Area, the permanent storage volume of this dam is low. In addition, the drainage area contributing runoff to the impoundment behind the dam is only 0.25 sq. miles, which due to its small area would provide limited runoff to the impoundment following any drawdown in water levels. Therefore, little water would be available for flow management from this dam.

## Potential Impacts of Storage and Release of Relief Flows

Dream Lake discharges from a culvert pipe under the dam and Baboosic Lake Road and into a large wetland complex. No distinct channel is mapped in this area and it is suspected that water from the wetland discharges to an unnamed tributary which then flows southeast to discharge into the Souhegan Designated River. There is limited development downstream of the dam, although the unnamed tributary does cross Spring Road, Upham Road and Thorntons Ferry Road before discharging into the Souhegan.

The large wetland complex downstream of the outlet of the dam could reduce the effectiveness of any relief flows released from it by temporarily storing the released water. Insufficient information is available to determine the amount of water that could be stored by the wetland and its resulting impact on any relief flows.

## Potential for Dam Management to Support Instream Flow Requirements

The potential for Dream Lake Dam to provide relief flow to the Souhegan Designated River is low due to it being privately owned, the low amount of storage potentially available, the small drainage upstream of the dam and the presence of a large wetland complex immediately downstream of its outlet.

The dam does have an outlet structure that would allow for controlled releases of water from the lake, although the discharge rating for the structure would need to be confirmed. In addition, the point of contribution to the Souhegan Designated River is downstream of the last direct withdrawal (Souhegan Woods Golf Club) from the river. Releases from Dream Lake Dam could potentially provide relief flow downstream of this withdrawal, but only for a brief period of time.

**Dam Management Activity**

No dam management activity is required at this time.

**Schedule for Dam Management Plan Implementation**

Since no dam management plan activity is currently required for Dream Lake Dam, there is no implementation schedule.

**Estimated Cost of the Implementation of the Dam Management Plan**

Since no dam management plan activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**

**Owner**: Emmagene Riccitelli
**Address**: 14 Dream Lake Drive, Amherst NH 03031
**Contac**t: Same as owner
**Phone**: Not available
**Email**: Not available

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Dream Lake Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **6.5** |
| **Freeboard (ft)** | **NA** |
| **Type of spillway controls or outlet works** | **Stops Logs** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **10.4** |
| **Drainage area (sq. miles)** | **0.25** |
| **Maximum storage (ac-ft)** | **36.24** |
| **Normal or permanent storage (ac-ft)** | **15.44** |
| **Total discharge capacity (cfs)** | **8** |
| **Maximum unoperated discharge (cfs)** | **8** |
| **Design storm discharge (cfs)** | **NA** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **NA** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #007.15

Note:

NA – not available from NH Dams Data Sheet.

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

# DAM MANAGEMENT PLAN

## New Wilton Reservoir Dam (State Dam ID #254.09)

Figure 1 – New Wilton Reservoir outlet, photo taken June 15, 2005.

### Introduction

The New Wilton Reservoir Dam (lat. $42^{o}$ 50’ 32”, long $-71^{o}$ 46’ 16”) is located on Stockwell Brook, a tributary to Stony Brook, in Wilton, New Hampshire and south of Sand Hill Road. This dam is municipally owned (see contact information), its status is considered to be active and its designated use is for water supply. The reservoir has not been used as a water supply since 1988 due to the development of a groundwater supply source. The dam is accessible to the public.

### Dam Design

The dam was reportedly built in 1933, and is constructed of concrete. The outlet structure is a drop inlet and water levels can be managed by the installation of stoplogs along with a gate (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

### Minimum Flow, Flowage Rights or Contractual Obligations

None, according to the owner.

**Riparian Property Obligations or Agreements**

None, according to the owner, the surrounding land is publicly owned.

**Water Quality Requirements or Limits**

None, according to the owner.

**Assessment of Potential Water Availability**

DES Dam Bureau files show, the maximum storage volume for the New Wilton Reservoir Dam is 335 acre-feet (or ac-ft), while its permanent storage volume is 240 ac-ft, with the difference being 95 ac-ft (4.1 million cu. ft. or 31 million gallons). When compared with the other dams in this Water management Planning Area, the permanent storage volume of this dam is of moderate size. The drainage area contributing runoff to the impoundment is only 0.4 sq. miles, which is small. Therefore, the water available from this dam for flow management is considered moderate to low.

**Potential Impacts of Storage and Release of Relief Flows**

The shoreline of the pond is undeveloped and there are no significant wetlands mapped in the pond or within its immediate drainage. So the potential impacts of the storage and release of any relief flows should be minimal.

**Potential for Dam Management to Support Instream Flow Requirements**

Factors supporting the potential use of the New Wilton Reservoir Dam for flow management include; the public ownership of the dam, the existence of flow control structures (although they may require upgrading), the absence of residences on the reservoir and because it is no longer used as a public water supply source.

The location of the New Wilton Reservoir Dam in the central portion of the Souhegan River drainage basin is also favorable. Releases from this dam would be conveyed by Stockwell Brook to Stony Brook, which then discharges to the Souhegan Designated River in Wilton. These releases could provide some relief flow to the lower portion of Souhegan Designated River.

The limiting factors relative to this site include the moderate volume of water storage and the small size of the drainage area providing runoff to the reservoir. These limiting factors are significant and, as a result, the potential for dam management at this site to meet the instream flow requirements is considered to be moderate to low.

**Dam Management Activity**

No dam management activity is required at this time.

**Schedule for Dam Management Plan Implementation**

Since no dam management plan activity is currently required New Wilton Reservoir Dam, there is no implementation schedule.

**Estimated Cost of the Implementation of the Dam Management Plan**

Since no dam management plan activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**

**Owner**: Town of Wilton
**Address**: P.O. Box 83, Wilton, NH 03086
**Contac**t: Steve Elliot, Water Commissioner
**Phone**: 603-654-9451
**Email**: None provided

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – New Wilton Reservoir Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **24** |
| **Freeboard (ft)** | **1.3** |
| **Type of spillway controls or outlet works** | **Stops Logs, Gate** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **22.1** |
| **Drainage area (sq. miles)** | **0.4** |
| **Maximum storage (ac-ft)** | **335** |
| **Normal or permanent storage (ac-ft)** | **240** |
| **Total discharge capacity (cfs)** | **127** |
| **Maximum unoperated discharge (cfs)** | **105** |
| **Design storm discharge (cfs)** | **33.3** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **33.3** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #254.09

Note:

NA – not available from NH Dams Data Sheet.

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**DAM MANAGEMENT PLAN**

**Osgood Pond Dam (State Dam ID #159.04)**

Figure 1 - Osgood Pond Dam, photo taken September 25, 2007.

## Introduction

The Osgood Pond Dam (lat 42$^{o}$ 49'14", long -71$^{o}$39'50") is located on Great Brook in the Town of Milford, New Hampshire and west of Osgood Road. This dam impounds Osgood Pond, which is listed by the Department of Environmental Services (DES) as a Great Pond. The dam is municipally owned (see contact information), its status is considered to be active and its designated use is for recreation. A parking area and a small park with several park benches are located at the dam.

## Dam Design

The dam was reportedly built in 1861, and is constructed of stone and earth materials. The outlet structure is constructed of concrete and stone and has slots for the installation of stoplogs (Figure 1). Details on the design and operation of the dam were obtained from the records of the DES Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

## Minimum Flow, Flowage Rights or Contractual Obligations

None, according to the owner.

**Riparian Property Obligations or Agreements**

None, according to the owner. Surrounding land is both privately and publically owned.

**Water Quality Requirements or Limits**

None, according to the owner.

**Assessment of Potential Water Availability**

DES Dam Bureau files show the maximum storage volume for the Osgood Pond Dam is 270 acre-feet (or ac-ft), while its permanent storage volume is 57 ac-ft, with the difference being 213 ac-ft (9.3 million cu. ft. or 69.4 million gallons). Due to a historical sedimentation problem in the pond, the actual permanent storage volume could be significantly less than reported. At the request of the Town, the New England District of the U.S. Army Corps of Engineers has proposed an aquatic ecosystem restoration project. This project would include the hydraulic dredging of sediment over a 15 acre area to increase the depth of Osgood Pond to 10 feet.

The drainage area upstream of the dam is 5.24 sq. miles, which would provide recharge to the pond. The outlet structure at the dam can accommodate stoplogs, so controlled releases of water from the dam could be performed.

**Potential Impacts of Storage and Release of Relief Flows**

Extensive forested and shrub wetlands are mapped within the immediate drainage of the impoundment. Raising or lowering of the water levels within the impoundment for long durations could affect these wetland complexes.

A concern associated with the release of water from Osgood Pond, in its current shallow condition, would be the possible water quality (thermal) impacts to the Souhegan Designated River.

**Potential for Dam Management to Support Instream Flow Requirements**

Operation of the Osgood Pond Dam for flow management may be potentially feasible, especially since the dam is owned and operated by a public agency and because the outlet structure allows for controlled flow releases. In addition, its location in the central portion of the Souhegan River basin would provide some water for relief flows in the lower basin. However, under its current condition, the amount of water actually available for flow management could be significantly lower than expected and any releases from the dam could result in water quality impacts to the Souhegan Designated River.

**Dam Management Activity**

No dam management activity is required at this time.

**Schedule for Dam Management Plan Implementation**

Since no dam management plan activity is currently required for Osgood Pond Dam, there is no proposed implementation schedule.

**Estimated Cost of the Implementation of the Dam Management Plan**

Since no dam management plan activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**

**Owner**: Town of Milford
**Address**: 289 South Street, Milford, NH 03055
**Contact**: Rick Riendeau, Director of Public Works
**Phone**: 603-673-1662
**Email**: rriendeau@milford.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Osgood Pond Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **9** |
| **Freeboard (ft)** | **1.9** |
| **Type of spillway controls or outlet works** | **Stops Logs** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **24.16** |
| **Drainage area (sq. miles)** | **5.24** |
| **Maximum storage (ac-ft)** | **270** |
| **Normal or permanent storage (ac-ft)** | **57** |
| **Total discharge capacity (cfs)** | **581.8** |
| **Maximum unoperated discharge (cfs)** | **581.8** |
| **Design storm discharge (cfs)** | **158.6** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **NA** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #159.04

Note:

NA – not available from NH Dams Data Sheet.

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**DAM MANAGEMENT PLAN**

**Pratt Pond Dam (State Dam ID #175.03)**

Figure 1 – Pratt Pond Dam outlet, photo taken June 10, 2005.

## Introduction

Pratt Pond Dam (lat. $42^o$ 44' 11", long. $-71^o$ 54' 20") is located on Pratt Pond Brook in New Ipswich, New Hampshire and off of Lower Pratt Pond Road. This dam impounds Pratt Pond, which is listed by the Department of Environmental Services (DES) as a Great Pond. This dam is privately owned (see contact information), its status is considered to be active and its designated use is for recreation. There is no public access at the dam or to the pond.

## Dam Design

The dam was reportedly built in 1890, and is constructed of concrete. The outlet structure is constructed of concrete and has slots for the installation of stoplogs (Figure 1). Details on the design and operation of the dam were obtained from the records of the DES Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

## Minimum Flow, Flowage Rights or Contractual Obligations

The Pratt Pond Association stated that it owns the flowage rights from the dam to the stone arch bridge at Route 124 in New Ipswich (Warwick Mills).

## Riparian Property Obligations or Agreements

None, according to the owner, the property surrounding the pond is privately owned.

## Water Quality Requirements or Limits

No information is available on this; the dam owner is unaware of any such requirements.

## Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Pratt Pond Dam is 110 acre-feet (ac-ft), while its permanent storage volume is 58 ac-ft, with the difference being 52 ac-ft (2.3 million cu. ft. or 16.9 million gallons). When compared with the other dams being evaluated as part of this study the permanent storage volume of Pratt Pond Dam is relatively low. In addition, the drainage area behind the dam is only 0.74 sq miles. Therefore, little water would be available for flow management from this dam.

## Potential Impacts of Storage and Release of Relief Flows

One potential impact of the storage and subsequent release of water from the Pratt Pond Dam for flow management would be the modification and change in the ponds water level, which could affect waterfront residential property.

Any flow management releases from Pratt Pond Dam would travel via Pratt Pond Brook and into the Smithville Reservoir (also known as Souhegan River Site #35) approximately 1.5 miles downstream. From here the flow would be conveyed by the West Branch Souhegan River, joining with the flow from the South Branch Souhegan River, before discharging into Waterloom Pond. Any releases from Pratt Pond Dam would need to be coordinated with the DES Dam Bureau relative to the available storage and operation of the Smithville Reservoir to ensure conveyance of the relief flow to the Souhegan River.

## Potential for Dam Management to Support Instream Flow Requirements

Although the outlet structure of this dam would allow for managed releases, the overall potential for this dam to provide relief flow is low due to the private ownership of the dam and the property around the impoundment, the small amount of storage potentially available and its small drainage area. An additional complication is that any water released from the Pratt Pond Dam would discharge into the Smithville Reservoir, which is a flood control reservoir owned by the DES Dam Bureau.

## Dam Management Activity

No dam management activity is required at this time.

## Schedule for Dam Management Plan Implementation

Since no dam management plan activity is currently required for Pratt Pond Dam, there is no implementation schedule.

## Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management plan activity is currently required, there are no estimated costs.

## Dam Owner and Contact Information

**Owner**: Pratt Pond Association
**Address**: 99 Lower Pratt Pond Road, New Ipswich, NH
**Contac**t: Dan Blanchette, PPA President
**Phone**: 603-291-0393
**Email**: None provided.

## Conversion Factors for Volume and Flow Units

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Pratt Pond Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **6.5** |
| **Freeboard (ft)** | **1.5** |
| **Type of spillway controls or outlet works** | **Stops Logs** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **35** |
| **Drainage area (sq. miles)** | **0.74** |
| **Maximum storage (ac-ft)** | **110** |
| **Normal or permanent storage (ac-ft)** | **58** |
| **Total discharge capacity (cfs)** | **128** |
| **Maximum unoperated discharge (cfs)** | **36** |
| **Design storm discharge (cfs)** | **47** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **NA** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #175.03

Note:

NA – not available from NH Dams Data Sheet.

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**DAM MANAGEMENT PLAN**

**Souhegan Site 8 Dam (State Dam ID #147.28)**

Figure 1 – Souhegan Site 8 Dam outlet, photo taken June 17, 2005.

## Introduction

The Souhegan Site 8 Dam (lat. 42$^{o}$ 53' 07", long. -71$^{o}$ 46' 08"), also known as the James AG Putnam Dam, is located on Furnace Brook in Lyndeborough, New Hampshire and west of Cemetery Road. The dam impounds Furnace Brook and the resulting pond is referred to as Putnam Pond. Two other structures (Cemetery Dike #147.36 and South Dike #147.37) are also part of this flood control facility, but neither of them have an outlet structure, so they are only used to contain flood water behind the dam. This dam is owned by the New Hampshire Water Division (see contact information). The dam is active and its use is for flood control. There is public access to Putnam Pond, which is a conservation area (Putnam Pond Conservation Area).

Water released from the Souhegan Site 8 Dam flows into Furnace Brook, which flows to the southwest for approximately one mile before turning to the southeast. At a distance of approximately 1.7 miles, Furnace Brook discharges into Stony Brook. Stony Brook then flows 2.7 miles to the southeast to join the Souhegan Designated River.

## Dam Design

The dam was reportedly built in 1977 and is constructed of concrete and the outlet is a concrete drop inlet structure (Figure 1). Details on the design and operation of the dam were obtained from the records of the New Hampshire Department of Environmental Services (DES) Dam Bureau, the dam owner and operator. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

## Minimum Flow, Flowage Rights or Contractual Obligations

The state owned dam is located on private property. The state flowage rights only permit/allow for water levels to be raised during storm events to abate flooding downstream. The Putnam Pond Conservation Area surrounds the pond and is administered by the DES.

## Riparian Property Obligations or Agreements

There are warranty deed/easement deeds in place, according to the dam owner.

## Water Quality Requirements or Limits

There are no water quality requirements or limits associated with this dam.

## Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for the Souhegan River Site 8 Dam is 2,721 acre-feet (ac-ft), while its permanent storage volume is 180 ac-ft, with the difference being 2,541 ac-ft (110.7 million cu. ft. or 828 million gallons). When compared to the other dams in this Water Management Planning Area, this dam has the second highest potential storage. Because this is a flood control dam, the Natural Resources Conservation Service (NRCS), which contributed to the construction of the Souhegan River basin flood control dam network, requires that 85 percent of flood storage volume be available following a previous storm event. This restriction reduces the potential available storage volume to 381 ac-ft (16.6 million cu. ft. or 124 million gallons) which is large.

The drainage area upstream of the dam is 4.7 square miles, which should provide sufficient flow for the refilling of the reservoir during periods of below normal precipitation. Therefore, based on the available storage volume and the size of the contributing drainage area, the potential water available from this dam for flow management is considered high.

## Potential Impacts of Storage and Release of Relief Flows

The major impact of storing water within Putnam Pond above the permanent pool level would be the flooding of a large emergent and forested wetland complex located immediately east of the pond. Based on National Wetlands Inventory (NWI) mapping approximately 82 acres of wetlands would be inundated if water was stored at the maximum storage volume. These wetlands are part of a much larger wetland complex system located along Furnace Brook, which has been noted as one of the most important ecological landscapes in Lyndeborough (Trudeau 2009).

Storage of water for flow management would also result in elevated water levels on private land. The state flowage rights only permit/allow for water levels to be raised during storm events to abate flooding downstream. The existing agreements with landowners would have to be renegotiated to allow for non-flood control storage.

**Potential for Dam Management to Support Instream Flow Requirements**

When compared with the other flood storage dams in the Souhegan basin, the large potential storage volume of this dam makes it favorable for the storage and release of water for flow management. However, limiting factors for its use include: its location in the middle portion of the basin so that it would only provide water to the lower half of the designated river, the existing flowage rights which only allow for flood control storage, the impact of elevated water levels on the extensive wetlands at the site, the ecological value of this landscape feature and the need to retrofit the outlet structure to allow for the managed release of water. These limiting factors are significant and, as a result, the potential for dam management at this site to meet the instream flow requirements is considered to be low.

**Dam Management Activity**

No dam management activity is required at this time.

**Schedule for Dam Management Plan Implementation**

Since no dam management plan activity is currently required for Souhegan River Site 8, there is no implementation schedule.

**Estimated Cost of the Implementation of the Dam Management Plan**

Since no dam management plan activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**

**Owner**: NH Water Division
**Address**: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
**Contact**: James Gallagher
**Phone**: 603-271-3406
**Email**: james.gallagher@des.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Souhegan River Site 8 Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **682*** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **688.5&696.5*** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **680.6*** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **25** |
| **Freeboard (ft)** | **9** |
| **Type of spillway controls or outlet works** | **Drop Inlet** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **40** |
| **Drainage area (sq. miles)** | **4.7** |
| **Maximum storage (ac-ft)** | **2721** |
| **Normal or permanent storage (ac-ft)** | **180** |
| **Total discharge capacity (cfs)** | **7140** |
| **Maximum unoperated discharge (cfs)** | **7140** |
| **Design storm discharge (cfs)** | **NA** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **77.5** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #147.28

Note:

* - from DES Dam Bureau plans on file.
NA – not available from NH Dams Data Sheet.

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

Trudeau, J.M. 2009. Hills, Woods, and Sweeping Vales: A Natural Resources Inventory of Lyndeborough, New Hampshire. Preserve Land Works, Hancock, New Hampshire. Report prepared for Lyndeborough Conservation Commission.

**DAM MANAGEMENT PLAN**

**Souhegan River Site 12A South (State Dam ID #234.11) and Souhegan River Site 12A North (State Dam ID #234.16)**

Figure 1 – Souhegan River Site 12A South Dam, photo taken September 3, 2008.

## Introduction

The Souhegan River Site 12A South Dam (also known as the Senator Charles W. Tobey Dam) (lat. $42^o$ 47'42", long. $-71^o$ 49'45") is located on Richardson Brook in Temple, New Hampshire and east of State Route 45. This dam is owned by the NH Water Division (see contact information). The dam is active and its designated use is for flood control, but it is also used as the public water supply source for the Town of Greenville, New Hampshire. Tobey Reservoir is impounded by the Site 12A South Dam and the Site 12A North Dam.

Water released from the South Dam discharges into Richardson Brook, which flows south 1.6 miles and discharges into the Souhegan Designated River approximately 1.3 miles downstream of Greenville. The North Dam only includes a pond drain. Water released from the North River discharges to an unnamed tributary of Temple Brook and flows 5.5 miles to the north and then to the east via Blood Brook in Wilton and discharges into the Souhegan Designated River approximately 4 miles downstream of Greenville.

## Dam Design

Both dams were built in 1965 and are constructed of earth material. The outlet structure for the reservoir is a concrete riser located at the South Dam (Figure 1). Details on the design and operation of the dams were obtained from the Department of Environmental Services (DES) Dam Bureau, the operator of both dams. The information required by Env-Ws 1906.04 on the characteristics of the Site 12A South Dam is summarized in Table 1.

## Minimum Flow, Flowage Rights or Contractual Obligations

According to the DES Dam Bureau, there are deeded easement restrictions and the reservoir is the water supply source for the Town of Greenville, New Hampshire.

## Riparian Property Obligations or Agreements

Deeded easement restrictions and shared storage with Town of Greenville.

## Water Quality Requirements or Limits

No information is available on this; the facility owner is unaware of any such requirements.

## Assessment of Potential Water Availability

Management of the Site 12A Dam in combination with other impoundments could provide sufficient storage to reset flow above the Rare/Critical protected instream flow levels established for the Souhegan Designated River. The DES Dam Bureau files show the maximum storage volume for the Souhegan River Site 12A South as 3,310 acre-feet (ac-ft), while its permanent storage volume is 690 ac-ft, for a difference of 2,620 ac-ft (114 million cu. ft. or 854 million gallons). When compared to the other dams in this Water Management Planning Area, this dam has the largest potential storage volume. Because this is a flood control dam, the Natural Resources Conservation Service, which contributed to the construction of the Souhegan River basin flood control dam network, requires that 85 percent of the flood storage volume be available following a previous storm event. This condition reduces the potential available storage, left above the permanent storage, to 393 ac-ft (17.1 million cu. ft. or 128 million gallons), which is large when compared with the other dams in this Water Management Planning Area.

The volume that is available for use is much less than this. DES would use at most the volume within a two foot range of water level change in order to protect impoundment habitat. The surface area of the impoundment's permanent pool is 108 acres, resulting in about 216 ac-ft of storage within 2 feet of water level change.

In addition to the volume designated for flood storage, a portion of the total volume is designated for water supply. Based on the information available from the DES Dam Bureau, 652 ac-ft of the permanent storage (690 ac-ft) is designated for water supply.

The drainage area contributing runoff to the reservoir is 5.6 sq. miles, which should provide sufficient flow for the refilling of the reservoir during periods of below normal precipitation. Therefore, the potential of this dam for flow management is high. In addition, two DES Dam Bureau flood control dams (Sites 19 and 35) and Waterloom Pond Dam are located upstream. These facilities will also be used as sources of water for flow management. Based their relative location in the watershed, Sites 19 and 35 are responsible together for 21% of each flow release, Waterloom for 17%, and Site 12A for 62%. So long as each upstream impoundment supports at minimum these respective portions of the overall release, the instream flows will be met for the intervening segments.

**Potential Impacts of Storage and Release of Relief Flows**

A review of National Wetlands Inventory (NWI) mapping available for the site and for the stream between the South Dam and the Souhegan Designated River did not indicate any significant wetlands. In addition, a review of information available from the New Hampshire Natural Heritage Bureau (NHNHB) shows that there are no records of any federal or state-listed rare threatened or endangered (RTE) species or Exemplary Natural Communities for the area of the impoundment. As a result, the potential impacts of the storage and release of relief flows at the site appear limited.

**Potential for Dam Management to Support Instream Flow Requirements**

Management of this dam for instream flow could potentially provide 216 ac-ft of water for flow management on the Souhegan Designated River. In addition to the large volume of water stored in the Tobey Reservoir, its location in the upper portion of the Souhegan River basin is also a favorable characteristic of this site. Water released from the South Dam could provide relief flows to approximately 28.3 miles of the 34.1 miles of Designated River. Therefore, management of the Site 12A South Dam could provide sufficient water, in coordination with other dams in the Water Management Planning Area, to maintain the instream flow requirements for the Souhegan Designated River and this dam is a primary candidate for this purpose.

The chief purpose of the dam is for flood control. DES has contacted the Natural Resources Conservation Service regarding the addition of flow management as a designated use of the facility and has received their support for this concept. The Natural Resources Conservation Service has agreed with the use for instream flow purposes within the limits of maintaining the impoundment’s flood control capacity (Ellsmore, 2012).

The dam is also used as the Town of Greenville’s water supply. Per the design records of the facility, 652 ac-ft of water is to be available for the Town of Greenville’s water supply. DES has spoken with representatives of the Town of Greenville and they would support the use of the dam for the storage and release of release flows as long as the operation of the dam for this purpose does not impact storage for water supply. Operation of the dam for instream flow purposes should protect the water supply interests of the Town of Greenville.

The dam’s outlet will need to be changed to allow active management. The current configuration of the outlet structure is not designed for the storage and release of relief flows.

Additional evaluation will need to be performed to determine how the dam would be operated for flow management. In order to make the outlet structure operable for releasing flow, the outlet would need to be retrofitted. The cost to retrofit the outlet structure was estimated to be $136,000 by the DES Dam Bureau. A source of funding will need to be identified for the design, retrofitting, operation and maintenance of the dam for flow management.

**Dam Management Activity**

Site 12A Dam's primary use is described by the DES Dam Bureau as flood control. It is also the primary water supply source for the Town of Greenville. The use of Site 12A Dam will be expanded to include instream flow.

When water management activities are necessary, water will be released from the Site 12A Dam as described in Table 2 to create relief flows to support the protected instream flows on the Souhegan Designated River. For release flow conditions not described in Table 2, stream flow conditions that would attain the protected flows and management needs remain undefined. Stream flow conditions will continue to be compared to protected flow criteria and management needs will be defined if deficit conditions begin to occur. Coordination of these releases with other dams relative to timing and volumes will be addressed as part of the continuing evaluation of dam management described in the Water Management Plan.

Site 12A can assist in management of both the upper and lower Souhegan River segments. Protected flow conditions will be evaluated at two gages measuring the upper and lower segments. Flow conditions will be evaluated based on the records from the United States Geological Survey (USGS) gaging stations 01093852 Souhegan River (Site WLR-1) near Milford, NH and 01094000 Souhegan River at Merrimack, NH.

Site 12A Dam relief flows will be released when flows on the Souhegan Designated River fall below the Critical or Rare flow level for a period greater than their catastrophic duration or in response to repeated persistent events. The release from the Site 12A Dam will be coordinated with releases from other watershed dams to provide a relief flow.

The operation of the dam for the storage and release of relief flows for flow management will be performed to limit negative effects on impoundment habitat and the Town of Greenville's water supply system. To minimize the effects on habitat, the maximum water level change resulting from the storage and release of water for the relief flows will be two feet. No releases will be made if the effect of the release on water supply storage would result in conditions that would jeopardize human health and safety. As a result, DES anticipates increasing the impoundment water level by up to two feet to provide additional storage for instream flow protection which will ensure the water supply storage remains intact.

The DES Instream Flow Program will provide notification to the dam owner of an impending flow management release. The DES Dam Bureau as the owner of the dam will be responsible for the operation of dam to support the protected instream flows on the Souhegan Designated River. The DES Dam Bureau will take such actions as are necessary to adjust the controls of the outlet structure to increase flow from the dam by an amount and at a time identified by the DES

Instream Flow Program. The DES Instream Flow Program will notify the Town of Greenville and downstream dam owners in advance of planned relief flow releases from the Site 12A Dam.

**Schedule for Dam Management Plan Implementation**

DES will evaluate the retrofitting of the outlet structure and its reconstruction. This Dam Management Plan will be implemented when after funding is obtained and the reconstruction has been completed.

**Estimated Cost of the Implementation of the Dam Management Plan**

The estimated cost for the implementation of a Dam Management Plan for the Site 12A Dam includes both capital and recurring costs. The capital cost is associated with retrofitting the outlet structure, so it can be used for flow management of the Souhegan Designated River. The DES Dam Bureau has performed an initial evaluation of the potential cost to modify the outlet structures on two other flood control dams (Site 19 and Site 35) as part of this project. Assuming that the outlet structure at Site 12A would require similar modification, its cost would be $136,000 (see Appendix D). The recurring costs are associated with operation and maintenance of the outlet structure. This work requires that at least one trained DES employee travel to the site to adjust the outlet structure to release or store water. The costs associated with this work will be dependent upon the number of personnel involved, the number of site visits required to perform the necessary flow management releases and the travel time and mileage.

**Dam Owner and Contact Information**

**Owner**: NH Water Division
**Address**: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
**Contact**: James Gallagher
**Phone**: 603-271-3406
**Email**: james.gallagher@des.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Site 12A South Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **861.0*** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **873.0*** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **839.8*** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **33.5** |
| **Freeboard (ft)** | **8.5** |
| **Type of spillway controls or outlet works** | **Riser** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **108** |
| **Drainage area (sq. miles)** | **5.6** |
| **Maximum storage (ac-ft)** | **3310** |
| **Normal or permanent storage (ac-ft)** | **690** |
| **Total discharge capacity (cfs)** | **6310** |
| **Maximum unoperated discharge (cfs)** | **6310** |
| **Design storm discharge (cfs)** | **922** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **922** |

Sources of information: DES Dam Bureau, NH Dams Data Sheets for Dams #234.11 (Site 12A South) and 234.16 (Site 12A North).

Note:

*- from DES Dam Bureau plans on file.
NA – not available from NH Dams Data Sheets.

**References**


Department of Environmental Services (DES) Dam Data Sheet 234.11.

Department of Environmental Services (DES) 2013. Declaration of the Establishment of Protected Instream Flows for the Souhegan Designated River.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc.. NHDES-R-06-50.

Ellsmore, Richard. State Conservationist, USDA - NRCS, February, 15, 2012. Personal communication by email.

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**Table 2 - Two-Day Flow Release Contribution from Site 12A Dam in the Event of Instream Flow Water Management.**

| **Site 12A (Tobey Reservoir)** | | Upper Souhegan Release | | | | | |
|---|---|---|---|---|---|---|---|
| **Bioperiod** | **Bioperiod name** | **Start** | **End** | **Volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)** | **Two-day flow release contribution (cfs)** | **Change in water level from full pool (feet)** | **Notes** |
| 1 | Overwintering | 15-Nov | 28-Feb | 11.8 | 8.9 | 0.11 | |
| 2 | Spring Flood | 1-Mar | 30-Apr | 12.2 | 9.2 | 0.11 | |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 7.2 | 5.4 | 0.07 | |
| 6 | Salmon Spawning | 1-Oct | 14-Nov | -- | -- | -- | Release flow management currently too rare to define release flows. |
| **Site 12A (Tobey Reservoir)** | | Lower Souhegan Release | | | | | |
| 1 | Overwintering | 15-Nov | 28-Feb | 23.7 | 6.0 | 0.22 | |
| 2 | Spring Flood | 1-Mar | 30-Apr | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 20.2 | 5.1 | 0.19 | |
| 6 revised | Salmon Spawning | 1-Oct | 14-Nov | 54.9 | 13.9 | 0.51 | |

| **Waterbody** | **Area of flow responsibility (sq. mi.)** | **Percent contribution to protected flow release** | **Surface area of waterbody (acres)** | **Description of area of flow responsibility** |
|---|---|---|---|---|
| Site 19 and/or Site 35 | 21.4 | 21% | ~25 | upper SR watershed to entrance to WL Pond |
| Waterloom Pond | 38.8 | 17% | 75 | to confluence with Tobey Res outlet to SR |
| Site 12A (Tobey Reservoir) | 103.0 | 62% | 108 | to gage - Souhegan Near Milford |

**DAM MANAGEMENT PLAN**

**Souhegan River Site 15 Dam (State Dam ID #254.30)**

Figure 1 – Souhegan River Site 15 Dam outlet structure, photo taken June 15, 2005.

## Introduction

The Souhegan River Site 15 Dam (lat. $42^{o}$ 47' 54", long. $-71^{o}$ 48' 20") is located on King Brook in Wilton, New Hampshire and west of Heald Road. This dam is owned by the NH Water Division (see contact information), its status is considered to be active and its designated use is for flood control. The impoundment behind the dam is referred to as the King Brook Reservoir, which straddles town line of Temple (west) and Wilton (east).

Water from the dam is discharged into King Brook, which flows to the east and into Batchelder Pond, approximately 650 feet downstream of the dam. King Brook then flows from Batchelder Pond to its confluence with the Souhegan Designated River, approximately 1.2 miles downstream from the dam. The corridor along King Brook, between the dam and the river, is largely undeveloped, but the brook crosses Heald Road, Russell Hill Road, King Brook Road (four times) and State Route 31, just before it discharges into the Souhegan Designated River.

## Dam Design

The dam was reportedly built in 1963, and is constructed of earth material, while its outlet structure is a concrete riser (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, the dam owner and operator. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

**Minimum Flow, Flowage Rights or Contractual Obligations**
According to the DES Dam Bureau there are deeded easement restrictions.

**Riparian Property Obligations or Agreements**

The DES Dam Bureau did not indicate whether there were any riparian property obligations or agreements associated with this dam.

**Water Quality Requirements or Limits**

According to the DES Dam Bureau, there are no water quality requirements associated with their operation of the dam.

**Assessment of Potential Water Availability**

DES Dam Bureau files show, the maximum storage volume for the Souhegan River Site 15 Dam is 708 acre-feet (or ac-ft), while its permanent storage volume is 74 ac-ft, with the difference being 634 ac-ft (27.6 million cu. ft. or 206.6 million gallons). Because this is a flood control dam, the Natural Resources Conservation Service (NRCS), which contributed to the construction of the Souhegan River basin flood control dam network, requires that 85 percent of the flood storage volume be available following a previous storm event. This restriction reduces the potential available storage volume to 95.1 ac-ft (4.1 million cu. ft. or 31 million gallons). When compared to other existing flood control dams in the Souhegan River Water Management Planning Area, this value is considered to be low. An additional potential limiting factor is the small size of its contributing drainage area, 1.1 sq. miles, which could limit the volume of water available for the refilling of the reservoir during periods of below normal precipitation.

**Potential Impacts of Storage and Release of Relief Flows**

Within the upper portion of the impoundment area are mapped areas of emergent and forested wetlands. Portions of these wetland complexes could be inundated by water stored for flow augmentation. Depending on the depth and duration of inundation, these wetlands could be negatively impacted by water storage.

**Potential for Dam Management to Support Instream Flow Requirements**

Factors favoring the use of the Site 15 Dam for the storage and release of water for relief flows include; public ownership of the dam, the absence of residences around the impoundment and its location in the upper Souhegan River basin. With the dam located in the upper portion of the watershed, water released from it could augment flow in the lower two thirds of the basin.

Factors limiting this dam for consideration include; the existence of deeded easements that restrict the storage of water for flood control, the requirement to keep 85 percent of the storage volume available for the retention of flood runoff which significantly reduces the amount of water available for flow management, the small size of the contributing drainage area, the presence of emergent and forested wetlands that could be inundated by water storage. In addition, the outlet structure for the dam is manually operated and is currently configured to release water in response to flood events. The outlet structure would need to be retrofitted to allow for the managed release of flows from the dam. These limiting factors are significant and, as a result, the potential for dam management at this site to meet the instream flow requirements is considered to be low.

**Dam Management Activity**

Since the potential use of the Souhegan River Site 15 Dam for maintaining instream flow on the Souhegan Designated River is considered low, no dam management activity is currently required.

**Schedule for Dam Management Plan Implementation**

Since no dam management plan activity is currently required for this site, there is no implementation schedule.

**Estimated Cost of the Implementation of the Dam Management Plan**

Since no dam management activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**

| | |
|---|---|
| **Owner**: | NH Water Division |
| **Address**: | P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095 |
| **Contact**: | James Gallagher |
| **Phone**: | 603-271-3406 |
| **Email**: | james.gallagher@des.nh.gov |

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Site 15 Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **13** |
| **Freeboard (ft)** | **NA** |
| **Type of spillway controls or outlet works** | **Riser** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **69** |
| **Drainage area (sq. miles)** | **1.1** |
| **Maximum storage (ac-ft)** | **708** |
| **Normal or permanent storage (ac-ft)** | **74** |
| **Total discharge capacity (cfs)** | **NA** |
| **Maximum unoperated discharge (cfs)** | **1,040** |
| **Design storm discharge (cfs)** | **NA** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **24** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #254.30

Note:

NA – not available from NH Dams Data Sheet

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**DAM MANAGEMENT PLAN**

**Souhegan River Site 19 Dam (State Dam ID #175.19)**

Figure 1 – Souhegan River Site 19 Dam and outlet structure, photo taken June 15, 2005.

## Introduction

The Souhegan River Site 19 Dam (also known as the Ashburnham Road Dam or the South Branch Dam) (lat. 42$^{o}$ 43' 25", long. -71$^{o}$ 51'02") is located on the South Branch of the Souhegan River in New Ipswich, New Hampshire and east of Ashburnham Road. This dam is owned by the NH Water Division (see contact information). The dam is active and its use is for flood control.

Water released from the dam flows north in the South Branch of the Souhegan River. It then flows under Ashby Road and then joins with the West Branch of the Souhegan River and an unnamed tributary to form the Souhegan River, approximately 3,300 feet downstream of the dam. This point also represents the beginning of the Souhegan Designated River. Shortly downstream from this point the river then flows into Waterloom Pond, the impoundment formed by Waterloom Dam.

## Dam Design

The dam was built in 1962 and reconstructed in 1980. It is constructed of earth materials, while its outlet structure is a concrete drop inlet (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam

Bureau, the dam owner and operator. The information required by Env-Ws 1906.04 on the characteristics of the dam is summarized in Table 1.

**Minimum Flow, Flowage Rights or Contractual Obligations**

This state owned dam facility is located on private property. Deeded easements only permit the state to raise water levels during storm events to help prevent flooding downstream.

**Riparian Property Obligations or Agreements**

According to the DES Dam Bureau there are deeded easements. These rights limit the storage of flood waters to a specified level and to the time required for the impoundment to drain after a storm event.

**Water Quality Requirements or Limits**

There are no water quality requirements or limits associated with this dam.

**Assessment of Potential Water Availability**

Management of the Site 19 Dam in combination with other impoundments would provide sufficient storage to reset flow above the Rare/Critical protected instream flow levels established for the Souhegan Designated River. The DES Dam Bureau files show the maximum storage volume for the Souhegan River Site 19 Dam is 2,072 acre-feet (ac-ft), while its permanent storage volume is 85.3 ac-ft, for a difference of 1986.7 ac-ft (86.5 million cu. ft. or 647 million gallons). When compared to the other dams in this Water Management Planning Area, this dam has high potential storage. Because this is a flood control dam, the Natural Resources Conservation Service (NRCS), which contributed to the construction of the Souhegan River basin flood control dam network, requires that 85 percent of flood storage volume be available following a previous storm event. This restriction reduces the potential available storage volume to 298 ac-ft (13 million cu. ft. or 97 million gallons).

The volume that is available for use is much less than this. DES would use at most the volume within a two foot range of water level change in order to protect impoundment habitat. The effects of changing the water level on the use and enjoyment of the impoundment by abutting property owners and the public must also be considered. The property owners have an existing easement that would have to be changed before additional storage could be kept in the impoundment. The surface area of the impoundment's permanent pool is 25 acres, resulting in about 50 ac-ft of storage within 2 feet of water level change.

The drainage area upstream of the dam, which extends into Massachusetts, is 11.4 sq. miles, and should provide sufficient flow for the refilling of the reservoir during periods of below normal precipitation. Therefore, based on the available storage volume and the size of the contributing drainage area, the potential of this dam for flow management is high. Flow from this dam and Site 35 runs downstream via the Souhegan River to Waterloom Pond and to the outflow from Site 12A. All of these dams will be part of the flow releases for instream flow protection. Site

19 and Site 35 in combination will be responsible for maintaining flow protection downstream to Waterloom Pond. Based their relative location in the watershed, Sites 19 and 35 are responsible together for 21% of each flow release, Waterloom for 17%, and Site 12A for 62%. So long as each upstream impoundment supports at minimum these respective portions of the overall release, the instream flows will be met for the intervening segments.

**Potential Impacts of Storage and Release of Relief Flows**

The storage of water at the Site 19 Dam above its permanent pool level could negatively impact wetlands surrounding the existing impoundment. A preliminary analysis of the impact of the higher water elevations indicated that between 31 and 39 acres of wetland could be inundated by the increased storage. Since the duration and timing of the increased water elevations aren't known, the extent of the potential impact to the existing wetlands is also unknown. However, it is believed that if the water levels were raised by 5-10 feet through the growing season repeatedly, there could be a net loss of vegetated wetlands. To reduce the potential impacts of the storage and release of the relief flows on existing wetlands and the abutting properties, DES will limit the change in water level to a maximum of 2 feet. This limitation only applies to the management of the dam for relief flows and may be temporarily exceeded for flood control storage.

Based on a review of information available from the New Hampshire Natural Heritage Bureau (NHNHB), there do not appear to be any federal or state-listed Rare, Threatened or Endangered (RTE) species or any Exemplary Natural Communities in the vicinity of the site. As a result, they would not be affected by an increase in water levels at the site.

Waterloom Dam impounds Waterloom Pond and is a hydropower facility. The plant is operated on a run-of-river basis, and according to the dam operator it would not be negatively impacted by the release of water from the Site 19 Dam, although the operator of Waterloom Dam would require prior notification of any releases from the Site 19 Dam.

**Potential for Dam Management to Support Instream Flow Requirements**

Management of the Site 19 Dam could provide up to 50 ac-ft for flow management on the Souhegan Designated River. Actual use would probably be less. About 37 ac-ft would be sufficient for the most common management requirements, leaving substantial storage remaining. This would provide a substantial portion, but not all, of the water necessary to maintain the instream flow requirements for the Souhegan Designated River.

To reduce the potential impact to existing wetlands and to neighboring private property at Souhegan River Sites 19 and 35, DES will limit the maximum change in water level, for the storage and release of relief flows, to less than two feet. Management of the Site 19 Dam could provide over two times the volume of storage necessary to reset flow above the Rare/Critical protected instream flow level established for the lower Souhegan Designated River if the water levels were raised to 5-10 feet. Even after reducing the maximum water level change to 2 feet, this dam, in coordination with releases from other watershed dams, could provide sufficient water to maintain the instream flow requirements for the Souhegan Designated River. Therefore, this dam is a primary candidate for flow management.

The chief purpose of the dam is for flood control. DES has contacted the Natural Resources Conservation Service regarding the addition of flow management as a designated use of the facility and has received their support for this concept. The Natural Resources Conservation Service has agreed with the use for instream flow purposes within the limits of maintaining the impoundment's flood control capacity (Ellsmore, 2012).

Current landowner flowage right agreements must be included in developing and using increased storage within the impoundment. Currently, there are at least 20 landowners that have agreements with the DES Dam Bureau that only allow for the temporary storage of water for flood control and limit permanent flooding to the area at an elevation equal to the low level inlet of the outlet structure. These agreements would need to be re-negotiated to allow for periods during which water would be stored above normal conditions.

The dam's outlet will need to be changed to allow active management. The current configuration of the outlet structure is not designed for the storage and release of relief flows. Additional evaluation will need to be performed to determine how the dam would be operated for flow management. In order to make the outlet structure operable for releasing flow, the outlet would need to be retrofitted. The cost to retrofit the outlet structure was estimated to be $136,000 by the DES Dam Bureau. A source of funding will need to be identified for the design, retrofitting, operation and maintenance of the dam for flow management.

**Dam Management Activity**

Site 19 Dam's primary use is described by the DES Dam Bureau as flood control. The use of Site 19 Dam will be expanded to include instream flow.

When water management activities are necessary, water will be released as described in Table 2 from Site 19 Dam to create relief flows to support the protected instream flows on the Souhegan Designated River. For release flow conditions not described in Table 2, stream flow conditions that would attain the protected flows and management needs remain undefined. Stream flow conditions will continue to be compared to protected flow criteria and management needs will be defined if deficit conditions begin to occur. Coordination of these releases with other dams relative to timing and volumes will be addressed as part of the continuing evaluation of dam management described in the Water Management Plan.

Site 19 can assist in management of both the upper and lower Souhegan River segments. Protected flow conditions will be evaluated at two gages measuring the upper and lower segments. Flow conditions will be evaluated based on the records from the United States Geological Survey (USGS) gaging stations 01093852 Souhegan River (Site WLR-1) near Milford, NH and 01094000 Souhegan River at Merrimack, NH.

Site 19 Dam relief flows will be released when flows on the Souhegan Designated River fall below the Critical or Rare flow level for a period greater than their catastrophic duration or in response to repeated persistent events. The release from the Site 19 Dam will be coordinated with releases from other watershed dams to provide a relief flow.

The operation of the dam for the storage and release of relief flows for flow management will be performed to limit the potential effects on Site 19 shoreline habitat and abutting private property. To minimize the effects on the shoreline and abutting private property, the maximum water level change resulting from the storage and release of water for the relief flows will be 2 feet. DES anticipates that the maximum storage needed from this impoundment would result in about 1.5 feet of water level change. DES further anticipates that this water level change may occur partly as a small increase in storage and partly as a release from existing storage.

The DES Instream Flow Program will provide notification to the dam owner of an impending flow management release. The DES Dam Bureau as the owner of the dam will be responsible for the operation of dam to support the protected instream flows on the Souhegan Designated River. The DES Dam Bureau will take such actions as are necessary to adjust the controls of the outlet structure to increase flow from the dam by an amount and at a time identified by the DES Instream Flow Program. The DES Instream Flow Program will notify downstream dam owners in advance of planned relief flow releases from the Site 19 Dam.

**Schedule for Dam Management Plan Implementation**

This Dam Management Plan will be put into practice after the use of the dam's storage capacity if fully resolved. Agreements with neighboring landowners with deeded easements would be needed before adding water into storage. Use of existing storage could also be applied. When the issue of storage is resolved, DES will then proceed with the evaluation of the retrofitting of the outlet structure and its reconstruction. Once these steps are completed, this Dam Management will be implemented.

**Estimated Cost of the Implementation of the Dam Management Plan**

The estimated cost for the implementation of a Dam Management Plan for the Site 19 Dam includes both capital and recurring costs. The capital cost is associated with retrofitting the outlet structure, so it can be used for flow management of the Souhegan Designated River. The DES Dam Bureau has estimated that it would cost at least $136,000 to retrofit the outlet structure (see Appendix D). The recurring costs are associated with the operation and maintenance of the dam for its use for flow management. This work requires that at least one trained DES employee travel to the site to adjust the outlet structure to release or store water. The costs associated with this work will be dependent upon the number of personnel involved, the number of site visits required to perform the necessary flow management releases and the travel time and mileage.

**Dam Owner and Contact Information**

**Owner**: NH Water Division
**Address**: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
**Contac**t: James Gallagher
**Phone**: 603-271-3406

**Email**: james.gallagher@des.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Site 19 Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **940.9*** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **961.0*** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **931.0*** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **35.5** |
| **Freeboard (ft)** | **26.1** |
| **Type of spillway controls or outlet works** | **Drop Inlet** |
| **Dimensions of spillway controls or outlet works** | **25** |
| **Surface area (ac) of impoundment at maximum impoundment** | **115** |
| **Drainage area (sq. miles)** | **11.4** |
| **Maximum storage (ac-ft)** | **2072** |
| **Normal or permanent storage (ac-ft)** | **85.3** |
| **Total discharge capacity (cfs)** | **16,463** |
| **Maximum unoperated discharge (cfs)** | **16,463** |
| **Design storm discharge (cfs)** | **247** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **225** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #175.19.
Note:
* - from DES Dam Bureau plans on file
NA – not available from NH Dams Data Sheet.

## References


Department of Environmental Services (DES) Dam Data Sheet 175.19.

Department of Environmental Services (DES) 2013. Declaration of the Establishment of Protected Instream Flows for the Souhegan Designated River.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc.. NHDES-R-06-50.

Ellsmore, Richard. State Conservationist, USDA - NRCS, February, 15, 2012. Personal communication by email.

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**Table 2 - Two-Day Flow Release Contribution from Site 19 or Site 35 Dams in the Event of Instream Flow Water Management.**

| Site 19 and/or Site 35 | | Upper Souhegan Release | | | | | |
|---|---|---|---|---|---|---|---|
| **Bioperiod** | **Bioperiod name** | **Start** | **End** | **Volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)** | **Two-day flow release contribution (cfs)** | **Change in water level from full pool (feet)** | **Notes** |
| 1 | Overwintering | 15-Nov | 28-Feb | 11.8 | 3.0 | 0.24 | Water level change is calculated as from each of Site 19 and Site 35 |
| 2 | Spring Flood | 1-Mar | 30-Apr | 12.2 | 3.1 | 0.24 | Water level change is calculated as from each of Site 19 and Site 35 |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 7.2 | 1.8 | 0.14 | Water level change is calculated as from each of Site 19 and Site 35 |
| 6 | Salmon Spawning | 1-Oct | 14-Nov | -- | -- | -- | Release flow management currently too rare to define release flows. |
| **Site 19 and/or Site 35** | | Lower Souhegan Release | | | | | |
| 1 | Overwintering | 15-Nov | 28-Feb | 7.9 | 2.0 | 0.16 | Water level change is calculated as from each of Site 19 and Site 35 |
| 2 | Spring Flood | 1-Mar | 30-Apr | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 6.7 | 1.7 | 0.13 | Water level change is calculated as from each of Site 19 and Site 35 |
| 6 revised | Salmon Spawning | 1-Oct | 14-Nov | 18.4 | 4.6 | 0.37 | Water level change is calculated as from each of Site 19 and Site 35 |

| **Waterbody** | **Area of flow responsibility (sq. mi.)** | **Percent contribution to protected flow release** | **Surface area of waterbody (acres)** | **Description of area of flow responsibility** |
|---|---|---|---|---|
| Site 19 and/or Site 35 | 21.4 | 21% | ~25 | upper SR watershed to entrance to WL Pond |
| Waterloom Pond | 38.8 | 17% | 75 | to confluence with Tobey Res outlet to SR |
| Site 12A (Tobey Reservoir) | 103.0 | 62% | 108 | to gage - Souhegan Near Milford |

**DAM MANAGEMENT PLAN**

**Souhegan River Site 33 Dam (State Dam ID #254.34)**

Figure 1 – Souhegan River Site 33 Dam and outlet structure, photo taken June 17, 2007.

## Introduction

The Souhegan River Site 33 Dam, also known as the Dale Road Dam (lat. 42$^{o}$ 51'40", long. -71$^{o}$ 44' 58") is located on Curtis Brook in Wilton, New Hampshire and immediately east of Dale Street. This dam is owned by the NH Water Division (see contact information). The dam is active and its use is for flood control.

The dam impounds the upper portion of Curtis Brook, which then flows approximately 4,000 feet to the southwest to join with Stony Brook. Stony Brook then flows one mile to the southeast to join the Souhegan Designated River. There is little development around the impoundment and the drainage area upstream of the dam is rural in character.

## Dam Design

The dam was built in 1971 and reconstructed in 1976. It is constructed of earth materials, while its outlet structure is a concrete riser (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, the dam owner and operator. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

**Minimum Flow, Flowage Rights or Contractual Obligations**

According to the DES Dam Bureau there are deeded easement restrictions.

**Riparian Property Obligations or Agreements**

The DES Dam Bureau did not indicate whether there were any riparian property obligations or agreements associated with the dam.

**Water Quality Requirements or Limits**

There are no water quality requirements associated with the operation of the dam.

**Assessment of Potential Water Availability**

Dam Bureau records show the maximum storage volume for the Souhegan River Site 33 Dam is 900 acre-feet (ac-ft), while its permanent storage volume is 24 ac-ft, with the difference being 876 ac-ft (38.2 million cu. ft. or 285 million gallons). Because this is a flood control dam, the Natural Resources Conservation Service (NRCS), which contributed to the construction of the Souhegan River basin flood control dam network, requires that 85 percent of flood storage volume be available following a previous storm event. This restriction reduces the potential available storage volume to 131.4 ac-ft (5.7 million cu. ft. or 42.8 million gallons). When compared with the potential storage of the other flood control dams in the Souhegan River Water Management Planning Area this volume is considered low to intermediate.

The drainage area upstream of the dam is only 1 sq. mile, which could limit the volume of water available for the refilling of the reservoir during periods of below normal precipitation. Therefore, based on the available storage volume and the size of the contributing drainage area, the potential water available from this dam for flow management is considered low.

**Potential Impacts of Storage and Release of Relief Flows**

Based on a review of National Wetlands Inventory (NWI) mapping extensive wetlands exist within the storage area for the Site 33 Dam. These include approximately 37 acres of forested/shrub wetland and 22 acres of freshwater emergent wetland. The inundation of these areas by the storage of water for flow management would negatively impact them.

A review of information available from the New Hampshire Natural Heritage Bureau (NHNHB) shows that there are no records of rare species or exemplary natural communities for the area of the impoundment.

**Potential for Dam Management to Support Instream Flow Requirements**

Factors favoring the use of the Site 33 Dam for the storage and release of water to support the instream flows include the volume of water potentially available, the public ownership of the dam and the absence of residences around the impoundment.

Limiting factors include; the location of the dam in the middle of the basin so that it would only provide water to the lower half of the basin, the small size of its contributing drainage area, the negative impact that water storage could have on the extensive wetlands located at the site. The management of the dam for relief flow releases would also require retrofitting of the outlet structure. The outlet structure is presently manually operated and is configured to release water at flood levels. The outlet structure would need to be retrofitted to allow for the managed release of flows from the dam. These limiting factors are significant and, as a result, the potential for dam management at this site to support the instream flow requirements is considered to be low.

**Dam Management Activity**

Since the potential use of the Souhegan River Site 33 Dam for maintaining instream flow on the Souhegan Designated River is considered low, no dam management activity is required at this time.

**Schedule for Dam Management Plan Implementation**

Since no dam management plan activity is currently required for this site, there is no implementation schedule.

**Estimated Cost of the Implementation of the Dam Management Plan**

Since no dam management activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**

**Owner**: NH Water Division
**Address**: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
**Contact**: James Gallagher
**Phone**: 603-271-3406
**Email**: james.gallagher@des.nh.gov

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Site 33 Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **21** |
| **Freeboard (ft)** | **NA** |
| **Type of spillway controls or outlet works** | **Riser** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **12** |
| **Drainage area (sq. miles)** | **1.0** |
| **Maximum storage (ac-ft)** | **900** |
| **Normal or permanent storage (ac-ft)** | **24** |
| **Total discharge capacity (cfs)** | **NA** |
| **Maximum unoperated discharge (cfs)** | **2100** |
| **Design storm discharge (cfs)** | **1080** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **NA** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #254.34.

Note:

NA – not available from NH Dams Data Sheet

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**DAM MANAGEMENT PLAN**

**Souhegan River Site 35 Dam (State Dam ID #175.21)**

Figure 1 – Souhegan River Site 35 Dam, photo taken June 10, 2005.

## Introduction

The Souhegan River Site 35 dam (also known as the Smithville Dam) (lat. $42^{o}$ 44' 4", long. $-71^{o}$ 52' 43") is located on the West Branch of the Souhegan River in the New Ipswich, New Hampshire and north of Binney Hill Road. This dam is owned by the NH Water Division (see contact information). The dam is active and its use is for flood control.

Water released from the dam flows east in the West Branch of the Souhegan River to join with the South Branch of the Souhegan River and an unnamed tributary to form the Souhegan River, approximately 2.3 miles downstream of the dam. Shortly downstream from this point, the river flows into Waterloom Pond, the impoundment formed by Waterloom Dam.

## Dam Design

The dam was built in 1965, and is constructed of earth materials. The outlet structure is a concrete drop inlet (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, the dam owner and operator. The information required by Env-Ws 1906.04 on the characteristics of the dam is summarized in Table 1.

## Minimum Flow, Flowage Rights or Contractual Obligations

The impounded area of this state owned dam is located on private property. Deeded easements only permit the state to raise water levels during storm events to help prevent flooding downstream.

## Riparian Property Obligations or Agreements

According to the DES Dam Bureau there are deeded easement rights. These rights limit the storage of flood waters to a specified level and to the time required for the impoundment to drain after a storm event.

## Water Quality Requirements or Limits

There are no water quality requirements or limits associated with this dam.

## Assessment of Potential Water Availability

Management of the Site 35 Dam in combination with other impoundments could provide sufficient storage to reset flow above the Rare/Critical protected instream flow levels established for the Souhegan Designated River. DES Dam Bureau files show the maximum storage volume for the Souhegan River Site 35 Dam is 1,787 acre-feet (ac-ft), while its permanent storage volume is 37 ac-ft, for a difference of 1,750 ac-ft (76.2 million cu. ft. or 570 million gallons). When compared to the other dams in this Water Management Planning Area, this dam has the third largest potential storage. Because this is a flood control dam, the Natural Resources Conservation Service (NRCS), which contributed to the construction of the Souhegan River basin flood control dam network, requires that 85 percent of the flood storage volume be available following a previous storm event. This restriction reduces the potential available storage volume to 262.5 ac-ft (11.4 million cu. ft. or 85.5 million gallons).

The volume that is available for use is much less than this. DES would use at most the volume within a two foot range of water level change in order to protect impoundment habitat. The effects of changing the water level on the use and enjoyment of the impoundment by abutting property owners and the public must also be considered. The property owners have an existing easement that would have to be changed before additional storage could be kept in the impoundment. The surface area of the impoundment’s permanent pool is 24.9 acres, resulting in about 50 ac-ft of storage within 2 feet of water level change.

The drainage area upstream of the dam is 6.4 sq. miles. This should provide sufficient flow for the refilling of the reservoir during periods of below normal precipitation. Therefore, based on the available storage volume and the size of the contributing drainage area, the potential water available from this dam for flow management is high. Along with Site 19, Site 35 can help to augment flow in the Souhegan Designated River, first in the upper portion, and if storage allows, in the lower river. Based their relative location in the watershed, Sites 19 and 35 are responsible together for 21% of each flow release, Waterloom for 17%, and Site 12A for 62%. So long as each upstream impoundment supports at minimum these respective portions of the overall release, the instream flows will be met for the intervening segments.

**Potential Impacts of Storage and Release of Relief Flows**

To reduce the potential impact to existing wetlands and to neighboring private property at Souhegan River Site 35, DES will limit the maximum change in water level, for the storage and release of relief flows, to less than two feet. This limitation only applies to the management of the dam for relief flows and may be temporarily exceeded for flood control storage.

A review of information available from the New Hampshire Natural Heritage Bureau (NHNHB) shows that there do not appear to be any federal or state-listed Rare, Threatened or Endangered (RTE) species or any Exemplary Natural Communities in the vicinity of the site. As a result, they would not be affected by an increase in water levels at the site.

The upper portion of the river corridor downstream of the dam to Smithville is lightly developed and there are three small impoundments within this section of the West Branch. In this section, the West Branch passes below both Taylor Road and Page Hill Road. During a flow management release from the dam, some of the flow may be temporarily stored in the impoundments, but due to their small size this impact should be relatively small.

Waterloom Dam impounds Waterloom Pond and is a hydropower facility. The plant is operated on run-of-river basis and according to the dam operator it would not be negatively impacted by the release of water from the Site 35 Dam, although the operator of Waterloom Dam would require prior notification of any flow management releases from the Site 35 Dam.

**Potential for Dam Management to Support Instream Flow Requirements**

Management of the Site 35 Dam could provide up to 50 ac-ft for flow management on the Souhegan Designated River. Actual use would probably be less. About 37 ac-ft would be sufficient for the most common management requirements leaving substantial storage remaining. This would provide a substantial portion, but not all, of the water necessary to maintain the instream flow requirements for the Souhegan Designated River.

The chief purpose of the dam is for flood control. DES has contacted the Natural Resources Conservation Service regarding the addition of flow management as a designated use of the facility and has received their support for this concept. The Natural Resources Conservation Service has agreed with the use for instream flow purposes within the limits of maintaining the impoundment’s flood control capacity (Ellsmore, 2012).

Current landowner flowage right agreements must be included in developing and using increased storage within the impoundment. Currently, there are 19 landowners that have agreements with the DES Dam Bureau that only allow for the temporary storage of water for flood control and limit permanent flooding to the area at an elevation equal to the low level inlet of the outlet structure. These agreements would need to be re-negotiated to allow for periods during which water would be stored temporarily, which would result in a 2 foot increase in water levels compared to normal conditions.

The dam's outlet will need to be changed to allow active management. The current configuration of the outlet structure is not designed for the storage and release of relief flows. Additional evaluation will need to be performed to determine how the dam would be operated for flow management. In order to make the outlet structure operable for releasing flow, the outlet would need to be retrofitted. The cost to retrofit the outlet structure was estimated to be $136,000 by the DES Dam Bureau. A source of funding will need to be identified for the design, retrofitting, operation and maintenance of the dam for flow management.

**Dam Management Activity**

Site 35 Dam's primary use is described by the DES Dam Bureau as flood control. The use of Site 35 Dam will be expanded to include instream flow.

When water management activities are necessary, water will be released as described in Table 2 from Site 35 Dam to create relief flows to support the protected instream flows on the Souhegan Designated River. For release flow conditions not described in Table 2, stream flow conditions that would attain the protected flows and management needs remain undefined. Stream flow conditions will continue to be compared to protected flow criteria and management needs will be defined if deficit conditions begin to occur. Coordination of these releases with other dams relative to timing and volumes will be addressed as part of the continuing evaluation of dam management described in the Water Management Plan.

Site 35 can assist in management of both the upper and lower Souhegan River segments. Protected flow conditions will be evaluated at two gages measuring the upper and lower segments. Flow conditions will be evaluated based on the records from the United States Geological Survey (USGS) gaging stations 01093852 Souhegan River (Site WLR-1) near Milford, NH and 01094000 Souhegan River at Merrimack, NH.

Site 35 Dam relief flows will be released when flows on the Souhegan Designated River fall below the Critical or Rare flow level for a period greater than their catastrophic duration or in response to repeated persistent events. The release from the Site 35 Dam will be coordinated with releases from other watershed dams to provide a relief flow.

The operation of the dam for the storage and release of relief flows for flow management will be performed to limit the potential effects on Site 35 shoreline habitat and abutting private property. To minimize the effects on the shoreline and abutting private property, the maximum water level change resulting from the storage and release of water for the relief flows will be 2 feet. DES anticipates that the maximum storage needed from this impoundment would result in about 1.5 feet of water level change. DES further anticipates that this water level change may occur partly as a small increase in storage and partly as a release from existing storage.

The DES Instream Flow Program will provide notification to the dam owner of an impending flow management release. The DES Dam Bureau as the owner of the dam will be responsible for the operation of dam to support the protected instream flows on the Souhegan Designated River. The Dam Bureau will take such actions necessary to adjust the controls of the outlet structure to increase flow from the dam by an amount and at a time identified by the DES Instream Flow Program. The DES Instream Flow Program will notify downstream dam owners in advance of planned relief flow releases from the Site 35 Dam.

**Schedule for Dam Management Plan Implementation**

This Dam Management Plan will be put into practice after the use of the dam's storage capacity if fully resolved. Agreements with neighboring landowners with deeded easements would be needed before adding water into storage. Use of existing storage could also be applied. When the issue of storage is resolved, DES will then proceed with the evaluation of the retrofitting of the outlet structure and its reconstruction. Once the steps are completed, this Dam Management Plan will be implemented.

**Estimated Cost of the Implementation of the Dam Management Plan**

The estimated cost for the implementation of a Dam Management Plan for the Site 35 Dam includes both capital and recurring costs. The capital cost is associated with retrofitting the outlet structure so it can be used for flow management of the Souhegan Designated River. The DES Dam Bureau has estimated that it would cost at least $136,000 to retrofit the outlet structure (see Appendix D). The recurring costs are those associated with the operation and maintenance of the dam for its use for flow management. This work requires that at least one trained DES employee travel to the site to adjust the outlet structure to release or store water. The costs associated with this work will be dependent upon the number of personnel involved, the number of site visits required to perform the necessary flow management releases and the travel time and mileage.

**Dam Owner and Contact Information**

| | |
|---|---|
| **Owner**: | NH Water Division |
| **Address**: | P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095 |
| **Contact**: | James Gallagher |
| **Phone**: | 603-271-3406 |
| **Email**: | james.gallagher@des.nh.gov |

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Site 35 Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **966.5*** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **973.9*** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **961.3*** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **30** |
| **Freeboard (ft)** | **4.6** |
| **Type of spillway controls or outlet works** | **Drop Inlet** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **24.9** |
| **Drainage area (sq. miles)** | **6.4** |
| **Maximum storage (ac-ft)** | **1787** |
| **Normal or permanent storage (ac-ft)** | **37** |
| **Total discharge capacity (cfs)** | **9,135** |
| **Maximum unoperated discharge (cfs)** | **9,135** |
| **Design storm discharge (cfs)** | **12,670** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **1,306** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #175.21.

Note:

* - from DES Dam Bureau plans on file.
NA – not available from NH Dams Data Sheet.

**References**

Department of Environmental Services (DES) Dam Data Sheet 175.21.

Department of Environmental Services (DES) 2013. Declaration of the Establishment of Protected Instream Flows for the Souhegan Designated River.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc.. NHDES-R-06-50.

Ellsmore, Richard. State Conservationist, USDA - NRCS, February, 15, 2012. Personal communication by email.

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

**Table 2 - Two-Day Flow Release Contribution from Site 19 or Site 35 Dams in the Event of Instream Flow Water Management**

| Bio-period | Bioperiod name | Start | End | Volume needed to meet 90% of historical deficits with 20% buffer (ac-ft) | Two-day flow release contribution (cfs) | Change in water level from full pool (feet) | Notes |
|---|---|---|---|---|---|---|---|
| **Site 19 and/or Site 35** | | Upper Souhegan Release | | | | | |
| 1 | Overwintering | 15-Nov | 28-Feb | 11.8 | 3.0 | 0.24 | Water level change is calculated as from each of Site 19 and Site 35 |
| 2 | Spring Flood | 1-Mar | 30-Apr | 12.2 | 3.1 | 0.24 | Water level change is calculated as from each of Site 19 and Site 35 |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 7.2 | 1.8 | 0.14 | Water level change is calculated as from each of Site 19 and Site 35 |
| 6 | Salmon Spawning | 1-Oct | 14-Nov | -- | -- | -- | Release flow management currently too rare to define release flows. |
| **Site 19 and/or Site 35** | | Lower Souhegan Release | | | | | |
| 1 | Overwintering | 15-Nov | 28-Feb | 7.9 | 2.0 | 0.16 | Water level change is calculated as from each of Site 19 and Site 35 |
| 2 | Spring Flood | 1-Mar | 30-Apr | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 6.7 | 1.7 | 0.13 | Water level change is calculated as from each of Site 19 and Site 35 |
| 6 revised | Salmon Spawning | 1-Oct | 14-Nov | 18.4 | 4.6 | 0.37 | Water level change is calculated as from each of Site 19 and Site 35 |

| Waterbody | Area of flow responsibility (sq. mi.) | Percent contribution to protected flow release | Surface area of waterbody (acres) | Description of area of flow responsibility |
|---|---|---|---|---|
| Site 19 and/or Site 35 | 21.4 | 21% | ~25 | upper SR watershed to entrance to WL Pond |
| Waterloom Pond | 38.8 | 17% | 75 | to confluence with Tobey Res outlet to SR |
| Site 12A (Tobey Reservoir) | 103.0 | 62% | 108 | to gage - Souhegan Near Milford |

# DAM MANAGEMENT PLAN

## Swartz Pond Dam (State Dam ID #147.31)

Figure 1 – Swartz Pond Dam outlet structure, photo from DES Dam Bureau.

### Introduction

The Swartz Pond Dam (lat. $42^{o}$ 54’ 15”, long. $-71^{o}$ 47’ 50”) is located on an unnamed tributary to Stony Brook in Lyndeborough, New Hampshire and south of Joslin Road. This dam is privately owned (see contact information), its status is considered to be active and its designated use is for recreation. There is no public access to the dam or pond.

### Dam Design

The dam was reportedly built in 1930, and is constructed of stone and earth materials. The outlet structure is constructed of concrete with an uncontrolled spillway (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

### Minimum Flow, Flowage Rights or Contractual Obligations

None, according to the dam owner.

## Riparian Property Obligations or Agreements

None, according to the dam owner.

## Water Quality Requirements or Limits

None, according to the dam owner.

## Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for the Swartz Pond Dam is 42.2 acre-feet (ac-ft), while its permanent storage is 21 ac-ft, with the difference being 21.2 ac-ft (or 923,472 cu. ft. or 6.9 million gallons). When compared with the other dams in this Water Management Plan Area the permanent storage volume is relatively low. In addition, the drainage area contributing runoff to the impoundment behind the dam is only 0.25 sq. miles, which due to its small area would provide limited runoff to the impoundment following any drawdown in water levels. Lastly, the existing outlet structure is an uncontrolled spillway. Without the modification of this structure, controlled releases of water are not possible. Therefore, little water would be available for flow management from this dam.

## Potential Impacts of Storage and Release of Relief Flows

The potential impacts of flow management would be low. The area around the impoundment is undeveloped and no extensive wetlands have been mapped within the impoundment.

## Potential for Dam Management to Support Instream Flow Requirements

The potential for this dam to provide relief flows to the Souhegan Designated River is low due to its being privately owned, the low amount of storage potentially available, the small drainage area upstream of the dam and the lack of a controlled outlet structure. The location of the dam and its impoundment in the mid portion of the Souhegan River watershed is a positive attribute though. Any releases of water from this dam would potentially contribute flow to the middle and lower portions of the Souhegan Designated River via Stony Brook.

## Dam Management Activity

No dam management activity is required at this time.

## Schedule for Dam Management Plan Implementation

Since no dam management plan activity is currently required for Swartz Pond Dam, there is no implementation schedule.

## Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management plan activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**

**Owner**: Ms. Dorothy Swartz
**Address**: 50 Congress St. , Suite 832, Boston, MA 02109
**Contact**: Mr. Thomas Swartz
**Phone**: 603-654-2418
**Email**: None provided.

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Swartz Pond Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **8** |
| **Freeboard (ft)** | **3** |
| **Type of spillway controls or outlet works** | **Uncontrolled** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **10.6** |
| **Drainage area (sq. miles)** | **0.25** |
| **Maximum storage (ac-ft)** | **42.2** |
| **Normal or permanent storage (ac-ft)** | **21** |
| **Total discharge capacity (cfs)** | **161.2** |
| **Maximum unoperated discharge (cfs)** | **161.2** |
| **Design storm discharge (cfs)** | **51.2** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **NA** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #147.31

Note:

NA – not available from NH Dams Data Sheet.

**References**


Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

# DAM MANAGEMENT PLAN

## Waterloom Pond Dam (State Dam ID #175.09)

Figure 1 – Waterloom Pond Dam spillway and controlled outlet, photos taken June 10, 2005.

### Introduction

The Waterloom Pond Dam (lat. $42^{o}$ 44’ 58”, long. -$71^{o}$ 50’ 12”) is located on the main stem of the Souhegan River in New Ipswich, New Hampshire and east of River Road. This dam is privately owned (see contact information). The dam is active and its use is for hydroelectric power production.

### Dam Design

The dam was built in 1840 and is constructed of stone and earth materials and concrete. The outlet structure and spillway are constructed of concrete and stone (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

### Minimum Flow, Flowage Rights or Contractual Obligations

According to the dam owner, the facility must allow for a minimum outflow of 10 cubic feet per second (cfs) during the summer (June through September) and 15 cfs during the winter as per FERC, as inflow is available.

### Riparian Property Obligations or Agreements

None, according to the dam owner. However, there are residences on the shoreland areas.

**Water Quality Requirements or Limits**

The dam owner is unaware of any water quality requirements or limits.

**Assessment of Potential Water Availability**

Management of the Waterloom Pond Dam in combination with other impoundments would provide sufficient storage to reset flow above the Rare/Critical protected instream flow levels established for the Souhegan Designated River. DES Dam Bureau files show the maximum storage volume for Waterloom Dam is 665 acre-feet (or ac-ft), while its permanent storage volume is 420 ac-ft, for a difference of 245 ac-ft (10.7 million cu. ft. or 79.8 million gallons). This is the largest storage volume of any of the privately owned affected dams in the Souhegan River Water Management Planning Area.

The volume that is available for use is much less than this. DES would use at most the volume within a two foot range of water level change in order to protect impoundment habitat. There are also the effects of changing the water level on the use and enjoyment of the impoundment by abutting property owners and the public must also be considered. The surface area of the impoundment's permanent pool is 75 acres, resulting in about 150 ac-ft of storage within 2 feet of water level change. However, based on the dam's FERC license and landowner expectations for pond levels, it is likely that nine inches is the largest acceptable change, which represents about 56 ac-ft of storage.

The drainage area upstream of the dam is 23.1 sq. miles, which is the largest contributing area of all of the affected dams evaluated. Therefore, the potential of this dam for flow management is high. In addition, two DES Dam Bureau flood control dams (Sites 19 and 35) are located upstream. These facilities will also be used as sources of water for flow management and any water released from them would directly contribute to flow from Waterloom Dam. Waterloom Dam will be used to increase the flow release pulse arriving from Site 19 and Site 35. Based their relative location in the watershed, Sites 19 and 35 are responsible together for 21% of each flow release, Waterloom for 17%, and Site 12A for 62%. So long as each upstream impoundment supports at minimum these respective portions of the overall release, the instream flows will be met for the intervening segments.

**Potential Impacts of Storage and Release of Relief Flows**

Since any release of water from Waterloom Dam would flow directly into the main stem of the Souhegan River, there are no anticipated impacts downstream other than the increased flow volumes, which is the intent of the dam management action. Considering that Waterloom Dam is located in the upper basin, flow management releases from it would benefit almost the entire Souhegan Designated River.

Releases from the dam could result in lower water surface levels on Waterloom Pond. These lowered water levels could impact the recreational use of the pond by reducing shoreline access.

The lowered water levels could also impact the large wetland complexes located west of River Road.

**Potential for Dam Management to Support Instream Flow Requirements**

Management of this dam for instream flow could potentially provide 56 ac-ft of water for flow management on the Souhegan Designated River. Management is limited by hydropower licensing conditions and potentially by abutting landowner interests.

Considering the volume of water potentially available in Waterloom Pond, and the location of the dam on the main stem of the Souhegan River and in the upper part of the watershed, the potential for dam management to meet the instream flow requirements is high. The dam is already managed for the production of hydroelectricity (run-of-river), so no modifications to the dam would be needed for releasing flow.

**Dam Management Activity**

Waterloom Pond Dam will continue to be operated as a run-of-river hydroelectric facility. The use of Waterloom Pond will be expanded to include instream flow.[1]

When water management activities are necessary, water will be released from the Waterloom Pond Dam as described in Table 2 to create relief flows to support the protected instream flows on the Souhegan Designated River. For release flow conditions not described in Table 2, stream flow conditions that would attain the protected flows and management needs remain undefined. Stream flow conditions will continue to be compared to protected flow criteria and management needs will be defined if deficit conditions begin to occur. Coordination of these releases with other dams relative to timing and volumes will be addressed as part of the continuing evaluation of dam management described in the Water Management Plan.

The Affected Dam Owner may use the relief flow released from Souhegan River Site 19 or Site 35 dams to generate power so long as Waterloom Pond Dam continues to pass inflow and meet Surface Water Quality Standards.

Waterloom Pond Dam can assist in management of both the upper and lower Souhegan River segments. Protected flow conditions will be evaluated at two gages measuring the upper and lower segments. Flow conditions will be evaluated based on the records from the United States Geological Survey (USGS) gaging stations 01093852 Souhegan River (Site WLR-1) near Milford, NH and 01094000 Souhegan River at Merrimack, NH.

DES is the owner and operator of the Souhegan River Site 19 and Site 35 dams and will contact the owner of Waterloom Pond Dam through the contact information in this document when a relief flow release is imminent and identify the start time. The notification will be by phone and email at least 24 hours in advance of the intended relief flow release. The Affected Dam Owner

[1] DES discussed management of Waterloom Pond with the dam's previous owner who agreed that management would be acceptable to his operations and would like fit within his federal licensing agreements. Change in ownership will require new approvals with the new owner.

will confirm receipt of this notification by phone or email. The owner will then operate Waterloom Pond Dam according to this plan to pass the flow release volume downstream with the least amount of attenuation.

**Schedule for Dam Management Plan Implementation**

By June 1, 2014 Waterloom Falls Dam will implement its Dam Management Plan and will institute the measures required to support the protected instream flows.

**Estimated Cost of the Implementation of the Dam Management Plan**

There are no significant anticipated costs associated with this Dam Management Plan.

**Dam Owner and Contact Information**

**Owner**: Ms. Kathleen R. Dolan
**Address**: 97 SECOND NH Turnpike, (PO Box 605), Hillsboro, NH 03244
**Contact**: Ms. Kathleen R. Dolan
**Phone**: 603-478-7828 (Emergency Cell 603-660-4174)
**Email**:

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Waterloom Pond Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **22.5** |
| **Freeboard (ft)** | **3.5** |
| **Type of spillway controls or outlet works** | **Ogee** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **75** |
| **Drainage area (sq. miles)** | **23.1** |
| **Maximum storage (ac-ft)** | **665** |
| **Normal or permanent storage (ac-ft)** | **420** |
| **Total discharge capacity (cfs)** | **NA** |
| **Maximum unoperated discharge (cfs)** | **1,950** |
| **Design storm discharge (cfs)** | **32,340** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **1,800** |

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #175.09

Note:

NA - not available from NH Dams Data Sheet

**References**


Department of Environmental Services (DES) Dam Data Sheet 175.09.

Department of Environmental Services (DES) 2013. Declaration of the Establishment of Protected Instream Flows for the Souhegan Designated River.

Department of Environmental Services (DES) 2008. Final Souhegan River Protected Instream Flow Report. Prepared by University of New Hampshire, University of Massachusetts and Normandeau Associates, Inc.. NHDES-R-06-50.
NH DES Dam Data Sheet 175.09

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11 .

**Table 2 - Two-Day Flow Release Contribution from Waterloom Pond Dam in the Event of Instream Flow Water Management.**

| **Waterloom Pond** | | Upper Souhegan Release | | | | | |
|---|---|---|---|---|---|---|---|
| **Bioperiod** | **Bioperiod name** | **Start** | **End** | **Volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)** | **Two-day flow release contribution (cfs)** | **Change in water level from full pool (feet)** | **Notes** |
| 1 | Overwinterin g | 15-Nov | 28-Feb | 9.6 | 2.4 | 0.13 | |
| 2 | Spring Flood | 1-Mar | 30-Apr | 9.9 | 2.5 | 0.13 | |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 5.9 | 1.5 | 0.08 | |
| 6 | Salmon Spawning | 1-Oct | 14-Nov | -- | -- | -- | Release flow management currently too rare to define release flows. |
| **Waterloom Pond** | | Lower Souhegan Release | | | | | |
| 1 | Overwinterin g | 15-Nov | 28-Feb | 6.4 | 1.6 | 0.09 | |
| 2 | Spring Flood | 1-Mar | 30-Apr | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- | Release flow management currently too rare to define release flows. |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 5.5 | 1.4 | 0.07 | |
| 6 revised | Salmon Spawning | 1-Oct | 14-Nov | 14.9 | 3.8 | 0.20 | |

| Waterbody | Area of flow responsibility (sq. mi.) | Percent contribution to protected flow release | Surface area of waterbody (acres) | Description of area of flow responsibility |
|---|---|---|---|---|
| Site 19 and/or Site 35 | 21.4 | 21% | ~25 | upper SR watershed to entrance to WL Pond |
| Waterloom Pond | 38.8 | 17% | 75 | to confluence with Tobey Res outlet to SR |
| Site 12A (Tobey Reservoir) | 103.0 | 62% | 108 | to gage - Souhegan Near Milford |

**DAM MANAGEMENT PLAN**

**Wheeler Pond Dam (State Dam ID #175.23)**

Figure 1 – Wheeler Pond Dam outlet, photo taken June 15, 2005.

## Introduction

Wheeler Pond Dam (lat. 42$^{o}$ 45' 22", long. -71$^{o}$ 53' 05") is located on Stark Brook in New Ipswich, New Hampshire and east of North Road. This dam impounds Wheeler Pond, which is listed by the Department of Environmental Services (DES) as a Great Pond. This dam is privately owned (see contact information), its status is considered to be active, but is in ruins and its designated use is for recreation. There is no public access to the dam or the pond.

## Dam Design

The date of construction for the dam is unknown and it is constructed of earth and rock materials and the outlet structure is uncontrolled (Figure 1). Details on the design and operation of the dam were obtained from the records of the DES Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

## Minimum Flow, Flowage Rights or Contractual Obligations

None, according to the owner.

## Riparian Property Obligations or Agreements

None, according to the owner.

## Water Quality Requirements or Limits

Unknown, according to the owner.

## Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Wheeler Pond Dam is 32.89 acre-feet (or ac-ft), while its permanent storage volume is 10.89 ac-ft, with the difference being 22 ac-ft (958,320 cu. ft. or 7.2 million gallons). Information on the drainage basin area was not available from the NH Dam Data Sheet, so it was estimated using the U.S. Geological Survey Streamstats web based program. The estimated drainage basin area upstream of Wheeler Pond Dam is only 0.23 sq. miles. When compared to other dams in this Water Management Planning Area, both the permanent storage volume and the contributing drainage area associated with Wheeler Pond Dam are low. Therefore, little water would be available from this dam for flow management.

## Potential Impacts of Storage and Release of Relief Flows

The shoreline of Wheeler Pond is undeveloped. Emergent wetlands are mapped along the northern and eastern portions of the pond. Raising or lowering water levels on the pond for long durations could impact these wetlands.

Water from Wheeler Pond Dam travels south via Stark Brook and discharges into the Smithville Reservoir (also known as Souhegan River Site #35) about 1.8 miles downstream. As a result, any flow management releases from Wheeler Pond Dam would need to be coordinated with the DES Dam Bureau, relative to the available storage and operation of the Smithville Reservoir, to ensure conveyance of this water to the Souhegan River.

## Potential for Dam Management to Support Instream Flow Requirements

The potential for this dam for flow management is low due to the small amount of water available, the small contributing drainage area, the poor condition of the dam and its lack of a controlled outlet structure.

## Dam Management Activity

No dam management activity is required at this time.

## Schedule for Dam Management Plan Implementation

Since no dam management plan activity is currently required for Wheeler Pond Dam, there is no implementation schedule.

**Estimated Cost of the Implementation of the Dam Management Plan**

Since no dam management plan activity is currently required, there are no estimated costs.

**Dam Owner and Contact Information**

**Owner**: David Somero
**Address**: Wheeler Road, New Ipswich, NH 03071
**Contact**: Same as owner
**Phone**: 603-878-1285
**Email**: None provided.

**Conversion Factors for Volume and Flow Units**

| | | | |
|---|---|---|---|
| 1 | cubic foot = | 7.481 | gallons |
| 1 | gallon = | 0.1337 | cubic feet |
| 1 | acre-foot = | 43,560 | cubic feet |
| 1 | acre-foot = | 325,872 | gallons |
| 1 | cfs = | 448.86 | gpm |
| 1 | cfs = | 646,358.4 | gpd |
| 1 | cfs = | 0.65 | MGD |
| 1 | gpm = | 0.002227866 | cfs |
| 1 | gpd = | 0.00000154713 | cfs |
| 1 | MGD = | 1.5471 | cfs |

**Table 1 – Wheeler Pond Dam Characteristics**

| | |
|---|---|
| **Elevation (ft) of recreation pool or height relative to lowest spillway** | **NA** |
| **Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway** | **NA** |
| **Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway** | **NA** |
| **Height of the dam (ft) from toe to the highest point on the dam** | **5** |
| **Freeboard (ft)** | **NA** |
| **Type of spillway controls or outlet works** | **Uncontrolled** |
| **Dimensions of spillway controls or outlet works** | **NA** |
| **Surface area (ac) of impoundment at maximum impoundment** | **11** |
| **Drainage area (sq. miles)** | **0.23*** |
| **Maximum storage (ac-ft)** | **32.89** |
| **Normal or permanent storage (ac-ft)** | **10.89** |
| **Total discharge capacity (cfs)** | **NA** |
| **Maximum unoperated discharge (cfs)** | **NA** |
| **Design storm discharge (cfs)** | **NA** |
| **Estimated 50-year flood flow (cfs)** | **NA** |
| **Estimated 100-year flood flow (cfs)** | **75** |

Sources of information: DES Dam Bureau, NH Dams Data Sheet for Dam #175.23
*****New Hampshire Streamstats (streamstatsags.cr.usgs.gov)

Note:

NA – not available from the NH Dams Data Sheet.

**References**

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/28/11.

# Appendix D

# DES Dam Bureau Relief Flow Assessment for Sites 19 and 35

**Souhegan River Water Management Plan**

**August 2013**

# STATE OF NEW HAMPSHIRE
## INTER-DEPARTMENT COMMUNICATION

**DATE:** February 9, 2009

**FROM:** Daniel Mattaini, P.E.
Senior Project Engineer
Maintenance Section
Dam Bureau – Water Division

**AT (OFFICE):**

**SUBJECT:** Preliminary Assessment of the use of flood control Site 35 and Site 19 for releases of water during droughts by creating and utilizing extra storage

**TO**: Wayne Ives
Watershed Bureau – Water Division

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The feasibility of the use of the sites was checked by determining if enough usable storage was available, what the cost would be to retrofit the dams to operate them in this manner, and the extent of potential legal issues which would be involved in acquiring the rights from the landowners to permanently flood their property.

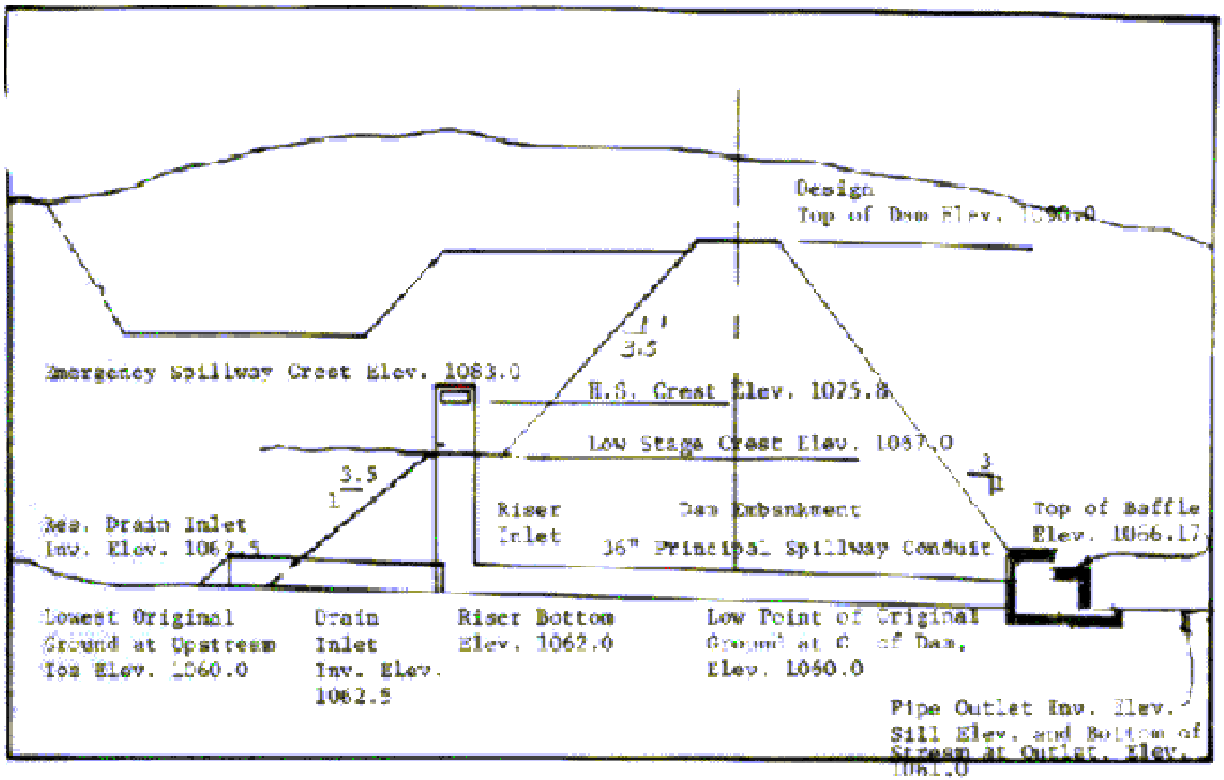
First a check on the availability of the required volume of water from the two sites was conducted and the volume compared to the expected required amount to meet the specified Lower Deficit Flow value (LDF) for this river system. Professor Ballestero had previously determined over a 48-hour period, 177.05 ac-ft are needed at a flow rate of 44.63 cfs for 48 hours to met this requirement. Incorporating with a 9 hour ramp up and 9 hour ramp down period, the total volume required increases 210.25 ac-ft of storage for the entire event.
The storage between the current pool elevation and the starting water surface elevation used in national Resource Conservation Service (NRCS) design storm flood routing calculations was determined. This potential available storage was further limited to pool elevations that provided enough head to drive the required LDF flowrate or greater though the outlet works. It was determined Site 35 has 118.2 ac-ft and Site 19 has 498.61 ac-ft of storage in this range.

A preliminary cost estimate was made to find the cost per tower to retrofit a new gate system at the location of the lower primary inlet. This would include increasing the size of the openings as required, to install a thimble and gate at the opening, and to install a hoist mechanism with a stainless steel stem to extend to the top of the tower. A new inlet would have to be installed at the new new pond level. The projected cost to modify each tower would be $136,000 per tower.

Investigations into the land ownership rights for the two sites indicate that while we have flowage rights on multiple landowners properties up to an elevation far above the elevation to which we are suggesting we raise the operating pool level, these rights are only applicable during high flow/flooding events. The current agreements with the landowners only allow us to permanently flood the areas at an elevation equal to the low level inlet. Site 19 would require negotiations with approximately 20 or more landowners to allow us to permanently inundate more of their land, and Site 35 would require another approximately 20 more landowners have an agreement negotiated.

Discussions with the NRCS would be required and their agreement required before any such use of the flood control sites could be considered.

Site 35 profile:



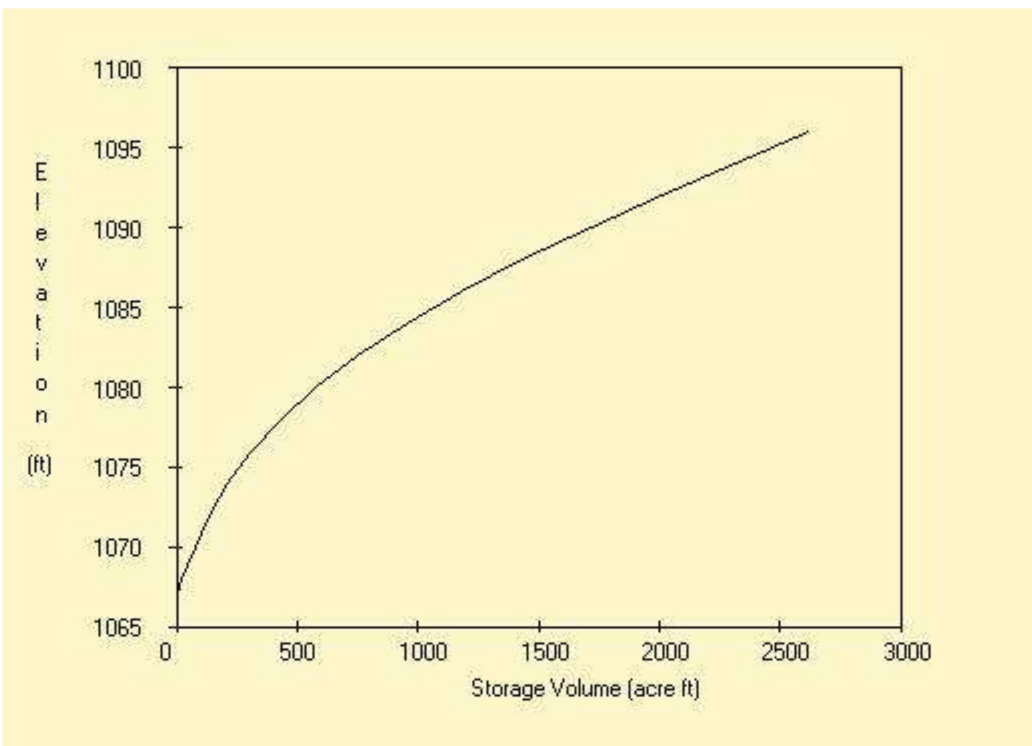

Site 35 rating table:

RATING TABLE NUMBER 1

| | ELEV. FEET | Q-TOTAL CFS | Q-PS CFS | Q-AUX. CFS | VOLUME AC-FT | AREA ACRE |
|---|---|---|---|---|---|---|
| 1 | 1067.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 1067.35 | 1.96 | 1.96 | 0.00 | 7.64 | 0.00 |
| 3 | 1067.71 | 5.54 | 5.54 | 0.00 | 15.29 | 0.00 |
| | TRANSITION TO ORIFICE FLOW, ELEV = 1068.06 FT | | | | | |
| 4 | 1068.06 | 10.17 | 10.17 | 0.00 | 23.17 | 0.00 |
| 5 | 1070.64 | 43.62 | 43.62 | 0.00 | 92.50 | 0.00 |
| 6 | 1073.22 | 60.85 | 60.85 | 0.00 | 181.16 | 0.00 |
| 7 | 1075.80 | 74.18 | 74.18 | 0.00 | 300.34 | 0.00 |
| 8 | 1076.09 | 84.24 | 84.24 | 0.00 | 315.75 | 0.00 |
| 9 | 1076.38 | 101.50 | 101.50 | 0.00 | 333.30 | 0.00 |
| | FULL CONDUIT FLOW, ELEV = 1076.67 FT | | | | | |
| 10 | 1076.67 | 123.43 | 123.43 | 0.00 | 350.86 | 0.00 |
| 11 | 1083.11 | 148.88 | 148.88 | 0.00 | 862.36 | 0.00 |
| 12 | 1089.56 | 170.57 | 170.57 | 0.00 | 1653.93 | 0.00 |
| 13 | 1096.00 | 189.80 | 189.80 | 0.00 | 2618.70 | 0.00 |

Site 35 storage:

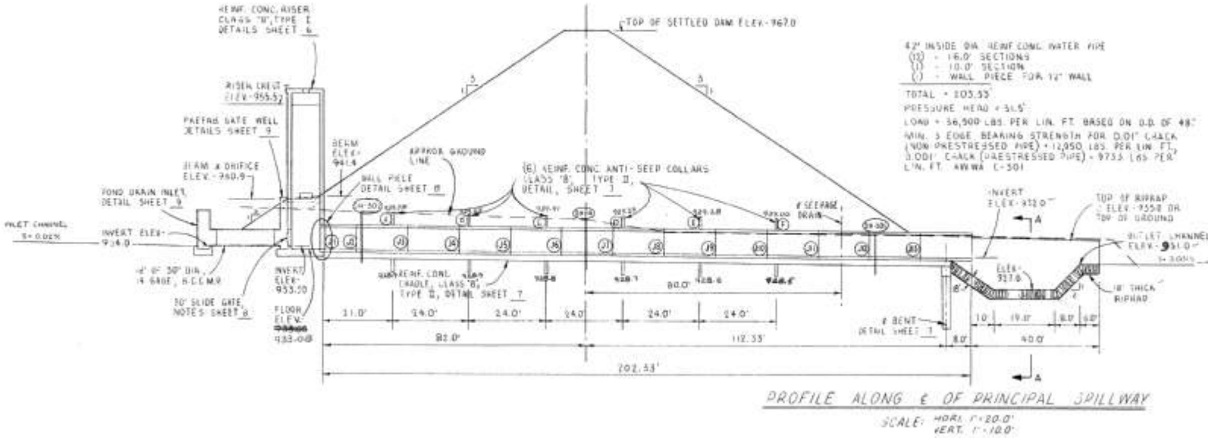
| Elevation: | Storage (Ac-ft) |
|---|---|
| 1067 | 0 |
| 1068 | 21.6 |
| 1070 | 72.5 |
| 1072 | 134.9 |
| 1074 | 210.7 |
| 1076 | 310.3 |
| 1078 | 431.4 |
| 1080 | 577 |
| 1082 | 750.7 |
| 1084 | 951.3 |
| 1086 | 1178.6 |
| 1088 | 1430.2 |
| 1092 | 2005.1 |
| 1096 | 2618.7 |




Site 35 outlet description:

Size of inlet gate: 3.00’w X 1.83’h.

Site 19 profile:




Site 19 rating table:

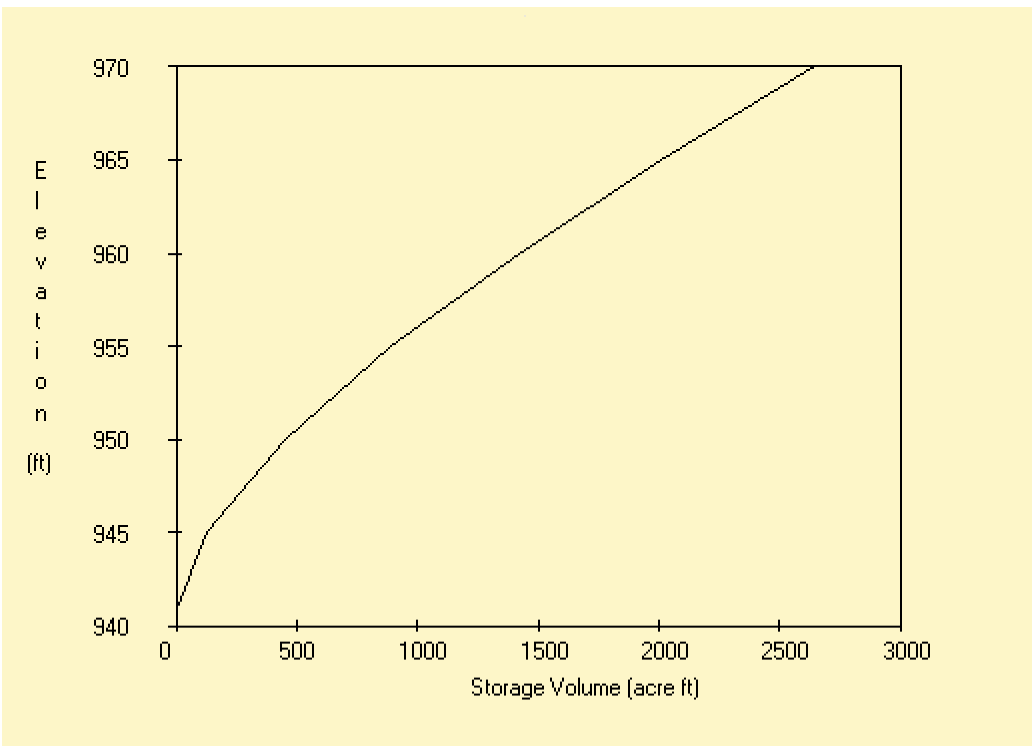
RATING TABLE DEVELOPED, SITE = 19 :
WITH PS DEVELOPED BY PROGRAM AND NO AUX. DATA GIVEN.

RATING TABLE NUMBER 1

| | ELEV. | Q-TOTAL | Q-PS | Q-AUX. | VOLUME | AREA |
|---|---|---|---|---|---|---|
| | FEET | CFS | CFS | CFS | AC-FT | ACRE |
| 1 | 940.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 941.09 | 0.99 | 0.99 | 0.00 | 5.97 | 0.00 |
| 3 | 941.29 | 2.81 | 2.81 | 0.00 | 11.94 | 0.00 |
| | TRANSITION TO ORIFICE FLOW, ELEV = 941.48 FT | | | | | |
| 4 | 941.48 | 5.16 | 5.16 | 0.00 | 17.90 | 0.00 |
| 5 | 946.15 | 39.35 | 39.35 | 0.00 | 200.12 | 0.00 |
| 6 | 950.83 | 55.41 | 55.41 | 0.00 | 520.09 | 0.00 |
| 7 | 955.50 | 67.76 | 67.76 | 0.00 | 943.45 | 0.00 |
| 8 | 956.06 | 96.67 | 96.67 | 0.00 | 1002.93 | 0.00 |
| 9 | 956.63 | 148.40 | 148.40 | 0.00 | 1062.41 | 0.00 |
| | FULL CONDUIT FLOW, ELEV = 957.19 FT | | | | | |
| 10 | 957.19 | 214.97 | 214.97 | 0.00 | 1121.90 | 0.00 |
| 11 | 961.46 | 233.77 | 233.77 | 0.00 | 1590.79 | 0.00 |
| 12 | 965.73 | 251.13 | 251.13 | 0.00 | 2102.33 | 0.00 |
| 13 | 970.00 | 267.37 | 267.37 | 0.00 | 2647.69 | 0.00 |

Site 19 storage:

| Elevation: | Storage (Ac-ft) |
|---|---|
| 940.9 | 0 |
| 945 | 126.1 |
| 950 | 446.6 |
| 955 | 890.7 |
| 960 | 1418.1 |
| 965 | 2009 |
| 970 | 2647.7 |




Site 19 outlet description:

Size of inlet: 3.75'w X 1'h.

SITES program output for Site 19:

```
1********************************************************************************
 SITES XEQ 11/06/2008   WATER RESOURCE SITE ANALYSIS COMPUTER
PROGRAM
     VER 2005.1.3              (USER MANUAL - DATED OCTOBER 2007)
     TIME 07:28:19

 ************************** 80-80 LIST OF INPUT DATA
***************************

 SITES     01/01/200519        Souhegan Site 19             11.43     A1
 SAVMOV    0    101
 SAVMOV    101  1                                            1
 *         Original area = 7276.8 acres,  new = 7315.2 (1988= )
 *         Original CN = , new in 2007 = 68 woods good (1988 = )
 *         Original Tc =   hr., w/Spatial Analyst =  1.7 hr.
 *         baseflow in DAMS2 was 3.2 x   =  cfs
 *         now 3.2 CSM x 11.43 = 36.6 cfs
 STRUCTURE 19
                 940.9                          0
                 945                          126.1
                 950                          446.6
                 955                          890.7
                 960                          1418.1
                 965                          2009
                 970                          2647.7
 ENDTABLE
 WSDATA    5C 19  AC 68       7315.2    3.5
 BASEFLOW           3.2
 PDIRECT   2.15      6.4       12.1
 POOLDATA  ELEV              940.9                          TC
 PSINLET   ELEV      1        21       955.5     1        3.75
 PSDATA    1        203.33    42                .012      933.75
 GRAPHICS  I
 GO,DESIGN LN
 SAVMOV    2    101  1                 19
 ENDJOB


*******************************************************************************

1SITES XEQ 11/06/2008 ------------- COMMENT PAGE -------------------------------
      VER 2005.1.3              Souhegan Site 19              WSID = 19
```

Original area = 7276.8 acres,  new = 7315.2 (1988= )

Original CN = , new in 2007 = 68 woods good (1988 = )

Original Tc =   hr., w/Spatial Analyst =  1.7 hr.

baseflow in DAMS2 was 3.2 x   =  cfs

now 3.2 CSM x 11.43 = 36.6 cfs

***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES.

1SITES -----------------------------------------------------------------------
XEQ 11/06/2008    Souhegan Site 19    WSID= 19
VER 2005.1.3    SUBW= 19
TIME 07:28:19    SITE = 19    PASS=  1   PART=  1

****************************  BASIC DATA ********************************

CLIMATE AREA - NOT DEFINED    DESIGN CLASS  C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION USED FOR AUXILIARY SPILLWAY IS;
NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

| PRECIP. - P-PS,1-DAY | P-PS,10-DAY | Q-SD | Q-FB |
|---|---|---|---|
| 6.40 | 12.10 | 0.00 | 0.00 |

| WSDATA - CN | DA-SM | TC/L | -/H | QRF |
|---|---|---|---|---|
| 68.00 | 11.43 | 3.50 | 0.00 | 0.00 |

| SITEDATA- PERM POOL | CREST PS | FP SED | VALLEY FL | 378? |
|---|---|---|---|---|
| 0.00 | 940.90 | 0.00 | 0.00 | NO |

| BASEFLOW | INITIAL EL | EXTRA VOL | SITE TYPE |
|---|---|---|---|
| 3.20 | 0.00 | 0.00 | DESIGN |

PSDATA - NO. COND COND L DIA/W -/H
1.00 203.33 42.00 0.00

PS N KE WEIR L TW EL
0.012 1.00 21.00 933.75

2ND STG ORF H ORF L START AUX.
955.50 1.00 3.75 0.00

ASCRESTS - AUX.1 AUX.2 AUX.3 AUX.4 AUX.5
0.00 0.00 0.00 0.00 0.00

AUX.DATA - REF.NO. RETARD. Ci TIE STATION INLET LENGTH
0 0.00 0.00 0

AUX.DATA - INLET N SIDE SLOPE EXIT N EXIT SLOPE ACTUAL AUX?
0.000 0.00 0.000 0.000 NO

BTM WIDTH - BW1 BW2 BW3 BW4 BW5
0.00 0.00 0.00 0.00 0.00

1SITES -----------------------------------------------------------------------
XEQ 11/06/2008 Souhegan Site 19 WSID= 19
VER 2005.1.3 SUBW= 19
TIME 07:28:19 SITE = 19 PASS= 1 PART= 2

| | | | | |
|---|---|---|---|---|
| CREST PS | 940.90 FT | 0.0 ACFT | 0.00 AC | 0.0 CFS |
| SED ACCUM | 940.90 FT | 0.0 ACFT | 0.00 AC | 0.0 CFS |
| BASEFLOW | 945.92 FT | 185.3 ACFT | 0.00 AC | 36.6 CFS |
| 2ND STAGE | 955.50 FT | 943.4 ACFT | 0.00 AC | 67.8 CFS |
| START ELEV | 945.92 FT | 185.3 ACFT | 0.00 AC | 36.6 CFS |

NRCS-PSH RAINFALL 1-DAY = 6.40 IN 10-DAY = 12.10 IN DA = 11.43 SM
RUNOFF 1-DAY = 2.93 IN 10-DAY = 5.08 IN

CLIMATIC INDEX = 2.15 CN 10-DAY = 50. CN 1-DAY = 68.
QRF = 110.32 CFS 956.21 FEET, FROM CLIMATIC INDEX COMPUTATION.

PEAK = 4184.8 CFS, AT 121.8 HRS.

ROUTED RESULT - HYD TYPE EMAX VOL-MAX AMAX QMAX
NRCS-PSH 966.85 FT 2245.7 ACFT 0.00 AC 255.4 CFS

PS STORAGE 2245.7 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 956.21 FT 1018.6 ACFT 110.32 CFS
CONTROL IS 1.000 BASEFLOW OR QRF

TIME TO DDT TEST DISCHARGE IS 9.44 DAYS - DRAWDOWN CONTINUING.

DRAWDOWN TIME = 9.43 DAYS, TO 110.4 CFS (LIMIT = 10.00 DAYS)

*************************************************************************************

RATING TABLE DEVELOPED, SITE = 19 :
WITH PS DEVELOPED BY PROGRAM AND NO AUX. DATA GIVEN.

RATING TABLE NUMBER 1

| | ELEV. | Q-TOTAL | Q-PS | Q-AUX. | VOLUME | AREA |
|---|---|---|---|---|---|---|
| | FEET | CFS | CFS | CFS | AC-FT | ACRE |
| 1 | 940.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 941.09 | 0.99 | 0.99 | 0.00 | 5.97 | 0.00 |
| 3 | 941.29 | 2.81 | 2.81 | 0.00 | 11.94 | 0.00 |
| | TRANSITION TO ORIFICE FLOW, ELEV = 941.48 FT | | | | | |
| 4 | 941.48 | 5.16 | 5.16 | 0.00 | 17.90 | 0.00 |
| 5 | 946.15 | 39.35 | 39.35 | 0.00 | 200.12 | 0.00 |
| 6 | 950.83 | 55.41 | 55.41 | 0.00 | 520.09 | 0.00 |
| 7 | 955.50 | 67.76 | 67.76 | 0.00 | 943.45 | 0.00 |
| 8 | 956.06 | 96.67 | 96.67 | 0.00 | 1002.93 | 0.00 |
| 9 | 956.63 | 148.40 | 148.40 | 0.00 | 1062.41 | 0.00 |
| | FULL CONDUIT FLOW, ELEV = 957.19 FT | | | | | |
| 10 | 957.19 | 214.97 | 214.97 | 0.00 | 1121.90 | 0.00 |
| 11 | 961.46 | 233.77 | 233.77 | 0.00 | 1590.79 | 0.00 |
| 12 | 965.73 | 251.13 | 251.13 | 0.00 | 2102.33 | 0.00 |
| 13 | 970.00 | 267.37 | 267.37 | 0.00 | 2647.69 | 0.00 |

1SITES -----------------------------------------------------------------------
XEQ 11/06/2008 Souhegan Site 19 WSID= 19
VER 2005.1.3 SUBW= 19
TIME 07:28:19 SITE = 19 PASS= 1 PART= 3

AUX. CREST 966.85 FT 2245.7 ACFT 0.00 AC 255.4 CFS

PS STORAGE 2245.7 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 956.21 FT 1018.7 ACFT 0.00 AC 110.4 CFS

ELEVATION OF LOW POINT IS ZERO. NO CRITERIA CHECK MADE FOR STRUCTURE CLASSIFICATION.

***** MESSAGE - NO INPUT DATA GIVEN FOR AUXILIARY SPILLWAY CREST AND/OR
BOTTOM WIDTH. NO AUXILIARY SPILLWAY ROUTINGS PERFORMED.
-----------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak = 255.40 CFS at 134.37 hrs., Location Point HYDOUT 1 19

1SITES....JOB NO. 1 COMPLETE.
-----------------------------------------------------------------------------

19 Souhegan Site 19

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

1 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

****************************************************************************
*******

SITES.....COMPUTATIONS COMPLETE

1 SUMMARY TABLE 1 SITES VERSION 2005.1.3
---------------- DATED 01/01/2005

| WATERSHED ID | RUN DATE | RUN TIME |
|---|---|---|
| 19 | 11/06/2008 | 07:28:19 |

>>> SITE SUBWS SUBWS DA CURVE TC TOTAL DA TYPE STRUC <<<

| ID | ID | (SQ MI) | NO. | (HRS) | (SQ MI) | DESIGN | CLASS |
|---|---|---|---|---|---|---|---|
| 19 | 19 | 11.43 | 68. | 3.50 | 11.43 | TR60 | C |

PASS DIA./ AUX.CREST BTM. MAX. MAX. EMB. INTEGR.* EXIT* TYPE
NO. WIDTH ELEV WIDTH HP ELEV VOL. DIST. VEL. HYD
(IN/FT) (FT) (FT) (FT) (FT) (CY) (FT) (FT/SEC)
---- ----- ------- ------ ---- ------- ------- ----- ------ ---------

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.3 ,01/01/2005
19 FILES

INPUT = C:\dan's old laptop files\NRCS new\NRCS BA new\SITES\Souhegan19\princ curvenumber SPATIAL.D2C
OUTPUT = C:\dan's old laptop files\NRCS new\NRCS BA new\SITES\Souhegan19\princ curvenumber SPATIAL.OUT
DATED 11/06/2008 07:28:19

GRAPHICS FILES GENERATED

OPTION "L" = C:\dan's old laptop files\NRCS new\NRCS BA new\SITES\Souhegan19\princ curvenumber SPATIAL.DRG DATED 11/06/2008 07:28:19

OPTION "P"  = C:\dan's old laptop files\NRCS new\NRCS BA new\SITES\Souhegan19\princ curvenumber SPATIAL.DHY DATED 11/06/2008 07:28:19

OPTION "E"  = C:\dan's old laptop files\NRCS new\NRCS BA new\SITES\Souhegan19\princ curvenumber SPATIAL.DEM DATED 11/06/2008 07:28:19

SITES program output for Site 35:

```
1********************************************************************************
 SITES XEQ 04/16/2007   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.0.1           (USER MANUAL - DATED MAY 2001)
     TIME 10:13:35

 ************************* 80-80 LIST OF INPUT DATA **************************


 SITES     01/01/200535       Shgn Site 35                6.3421875 A1
 SAVMOV    0    101
 SAVMOV    101  1                                           1
 *        UPDATED run with Beathann's data - new rainfall used too
 *        Original area = 4026, new =4059, (1988 was 4090)
 *        Original CN = 65, new in 2007 = 64 woods good, (1988 was 68)
 *        2007 woods fair at 68; in the south, more developed, used 68
 *        Original Tc = 2 hr., w/Spatial Analyst = 2.31 hr.
 *        baseflow in DAMS2 was 3.2 x 6.39 = 20.4 cfs
 *        now 3.2 CSM x 6.34 = 20.3 cfs
 STRUCTURE 35       Stage-Storage curve with sediment
                1067                      0
                1068                      21.6
                1070                      72.5
                1072                      134.9
                1074                      210.7
                1076                      310.3
                1078                      431.4
                1080                      577
                1082                      750.7
                1084                      951.3
                1086                      1178.6
                1088                      1430.2
                1092                      2005.1
                1096                      2618.7
 ENDTABLE
 WSDATA    5C 35  AC 64       4059      2.31
 BASEFLOW           3.2
 PDIRECT   2.15     6.4      12.1
 POOLDATA  ELEV              1067                           TC
 PSINLET   ELEV     1        18       1075.8    1.83     3
 PSDATA    1        160.6    36               .012     1062.5
 GRAPHICS  I
 GO,DESIGN LN
```

SAVMOV 2 101 1 35
ENDJOB

*****************************************************************************

1SITES XEQ 04/16/2007 ------------- COMMENT PAGE ------------------------------
VER 2005.0.1 Shgn Site 35 WSID = 35

UPDATED run with Beathann's data - new rainfall used too

Original area = 4026, new =4059, (1988 was 4090)

Original CN = 65, new in 2007 = 64 woods good, (1988 was 68)

2007 woods fair at 68; in the south, more developed, used 68

Original Tc = 2 hr., w/Spatial Analyst = 2.31 hr.

baseflow in DAMS2 was 3.2 x 6.39 = 20.4 cfs

now 3.2 CSM x 6.34 = 20.3 cfs

***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES.

1SITES ----------------------------------------------------------------------
XEQ 04/16/2007 Shgn Site 35 WSID= 35
VER 2005.0.1 Stage-Storage curve with sediment SUBW= 35
TIME 10:13:35 SITE = 35 PASS= 1 PART= 1

*************************** BASIC DATA ********************************
CLIMATE AREA - NOT DEFINED DESIGN CLASS C

STORM DISTRIBUTION PSH..10 DAY NRCS DESIGN STORM (CHAPTER 21, NEH4 & TR-60).

STORM DISTRIBUTION USED FOR AUXILIARY SPILLWAY IS;
NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

PRECIP. - P-PS,1-DAY P-PS,10-DAY Q-SD Q-FB
6.40 12.10 0.00 0.00

WSDATA - CN DA-SM TC/L -/H QRF
64.00 6.34 2.31 0.00 0.00

SITEDATA- PERM POOL CREST PS FP SED VALLEY FL 378?
0.00 1067.00 0.00 0.00 NO

BASEFLOW INITIAL EL EXTRA VOL SITE TYPE
3.20 0.00 0.00 DESIGN

PSDATA - NO. COND COND L DIA/W -/H
1.00 160.60 36.00 0.00

PS N KE WEIR L TW EL
0.012 1.00 18.00 1062.50

2ND STG ORF H ORF L START AUX.
1075.80 1.83 3.00 0.00

ASCRESTS - AUX.1 AUX.2 AUX.3 AUX.4 AUX.5
0.00 0.00 0.00 0.00 0.00

AUX.DATA - REF.NO. RETARD. Ci TIE STATION INLET LENGTH
0 0.00 0.00 0

AUX.DATA - INLET N SIDE SLOPE EXIT N EXIT SLOPE ACTUAL
AUX?
0.000 0.00 0.000 0.000 NO

BTM WIDTH - BW1 BW2 BW3 BW4 BW5
0.00 0.00 0.00 0.00 0.00

1SITES -----------------------------------------------------------------------
XEQ 04/16/2007 Shgn Site 35 WSID= 35
VER 2005.0.1 Stage-Storage curve with sediment SUBW= 35
TIME 10:13:35 SITE = 35 PASS= 1 PART= 2

CREST PS 1067.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 1067.00 FT 0.0 ACFT 0.00 AC 0.0 CFS

BASEFLOW 1068.89 FT 44.2 ACFT 0.00 AC 20.3 CFS

2ND STAGE 1075.80 FT 300.3 ACFT 0.00 AC 74.2 CFS

START ELEV 1068.89 FT 44.2 ACFT 0.00 AC 20.3 CFS

NRCS-PSH RAINFALL 1-DAY = 6.40 IN 10-DAY = 12.10 IN DA = 6.34 SM
RUNOFF 1-DAY = 2.55 IN 10-DAY = 4.26 IN

CLIMATIC INDEX = 2.15 CN 10-DAY = 45. CN 1-DAY = 64.
QRF = 61.21 CFS 1073.31 FEET, FROM CLIMATIC INDEX
COMPUTATION.

PEAK = 2800.3 CFS, AT 121.0 HRS.

ROUTED RESULT - HYD TYPE EMAX VOL-MAX AMAX QMAX
NRCS-PSH 1083.06 FT 857.0 ACFT 0.00 AC 148.6 CFS

PS STORAGE 857.0 ACFT, BETWEEN AUX. CREST AND SED. ACCUM
ELEVATIONS.

DRAWDOWN (DDT) TEST 1073.31 FT 184.4 ACFT 61.21 CFS
CONTROL IS 1.000 BASEFLOW OR QRF

TIME LIMIT REACHED = 10.00 DAYS; FLOW WAS 65.85 CFS, ELEV =
1074.19
ROUTING CONTINUING.

***** NOTE - EXTENSIVE TIME REQUIRED TO DRAWDOWN SITE;
COMPUTATIONS
STOPPED AT 30 DAYS ( 61.29 CFS).

***** NOTE - CREST OF AUX. RAISED TO HOLD 175.90 ACFT NOT
EVACUATED IN
DRAWDOWN TIME LIMIT. TOTAL STORAGE REQUIRED = 1032.93
ACFT,
NEW ELEVATION OF AUXILIARY SPILLWAY CREST = 1084.72 FT.

************************************************************************
*******
RATING TABLE DEVELOPED, SITE = 35 :

WITH PS DEVELOPED BY PROGRAM AND NO AUX. DATA GIVEN.

RATING TABLE NUMBER 1

| | ELEV. FEET | Q-TOTAL CFS | Q-PS CFS | Q-AUX. CFS | VOLUME AC-FT | AREA ACRE |
|---|---|---|---|---|---|---|
| 1 | 1067.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 1067.35 | 1.96 | 1.96 | 0.00 | 7.64 | 0.00 |
| 3 | 1067.71 | 5.54 | 5.54 | 0.00 | 15.29 | 0.00 |
| | TRANSITION TO ORIFICE FLOW, ELEV = 1068.06 FT | | | | | |
| 4 | 1068.06 | 10.17 | 10.17 | 0.00 | 23.17 | 0.00 |
| 5 | 1070.64 | 43.62 | 43.62 | 0.00 | 92.50 | 0.00 |
| 6 | 1073.22 | 60.85 | 60.85 | 0.00 | 181.16 | 0.00 |
| 7 | 1075.80 | 74.18 | 74.18 | 0.00 | 300.34 | 0.00 |
| 8 | 1076.09 | 84.24 | 84.24 | 0.00 | 315.75 | 0.00 |
| 9 | 1076.38 | 101.50 | 101.50 | 0.00 | 333.30 | 0.00 |
| | FULL CONDUIT FLOW, ELEV = 1076.67 FT | | | | | |
| 10 | 1076.67 | 123.43 | 123.43 | 0.00 | 350.86 | 0.00 |
| 11 | 1083.11 | 148.88 | 148.88 | 0.00 | 862.36 | 0.00 |
| 12 | 1089.56 | 170.57 | 170.57 | 0.00 | 1653.93 | 0.00 |
| 13 | 1096.00 | 189.80 | 189.80 | 0.00 | 2618.70 | 0.00 |

1SITES -----------------------------------------------------------------------

XEQ 04/16/2007 Shgn Site 35 WSID= 35
VER 2005.0.1 Stage-Storage curve with sediment SUBW= 35
TIME 10:13:35 SITE = 35 PASS= 1 PART= 3

AUX. CREST 1084.72 FT 1032.9 ACFT 0.00 AC 153.6 CFS

PS STORAGE 1032.9 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 1074.19 FT 220.1 ACFT 0.00 AC 65.8 CFS

ELEVATION OF LOW POINT IS ZERO. NO CRITERIA CHECK MADE FOR STRUCTURE CLASSIFICATION.

***** MESSAGE - NO INPUT DATA GIVEN FOR AUXILIARY SPILLWAY CREST AND/OR
BOTTOM WIDTH. NO AUXILIARY SPILLWAY ROUTINGS PERFORMED.

-----------------------------------------------------------------------------

Inflow Hyd 1 PSH-Peak = 148.62 CFS at 130.09 hrs., Location Point

HYDOUT 1 35

1SITES....JOB NO. 1 COMPLETE.
---------------------------------------------------------------------------

35 Shgn Site 35

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

1 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

************************************************************************
*******

SITES.....COMPUTATIONS COMPLETE

1 SUMMARY TABLE 1 SITES VERSION 2005.0.1
---------------- DATED 01/01/2005

| WATERSHED ID | RUN DATE | RUN TIME |
|---|---|---|
| 35 | 04/16/2007 | 10:13:35 |

>>> SITE SUBWS SUBWS DA CURVE TC TOTAL DA TYPE STRUC <<<

| SITE ID | SUBWS ID | SUBWS DA (SQ MI) | CURVE NO. | TC (HRS) | TOTAL DA (SQ MI) | TYPE DESIGN | STRUC CLASS |
|---|---|---|---|---|---|---|---|
| 35 | 35 | 6.34 | 64. | 2.31 | 6.34 | TR60 | C |

| PASS NO. | DIA./ WIDTH (IN/FT) | AUX.CREST ELEV (FT) | BTM. WIDTH (FT) | MAX. HP (FT) | MAX. ELEV (FT) | EMB. VOL. (CY) | INTEGR.* DIST. (FT) | EXIT* VEL. (FT/SEC) | TYPE HYD |
|---|---|---|---|---|---|---|---|---|---|

SITES.......SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.0.1,01/01/2005
35 FILES

INPUT = c:\NRCS BA new\SITES\Souhegan35\Site 35 princ curvenumber SPATIAL.D2C
OUTPUT = c:\NRCS BA new\SITES\Souhegan35\Site 35 princ curvenumber SPATIAL.OUT
DATED 04/16/2007 10:13:35

GRAPHICS FILES GENERATED

OPTION "L" = c:\NRCS BA new\SITES\Souhegan35\Site 35 princ curvenumber SPATIAL.DRG DATED 04/16/2007 10:13:35

OPTION "P" = c:\NRCS BA new\SITES\Souhegan35\Site 35 princ curvenumber SPATIAL.DHY DATED 04/16/2007 10:13:35

OPTION "E" = c:\NRCS BA new\SITES\Souhegan35\Site 35 princ curvenumber SPATIAL.DEM DATED 04/16/2007 10:13:35

# Appendix E

# Deficit Analysis Data

## Souhegan River Water Management Plan

## August 2013

APPENDIX E - DEFICIT ANALYSIS DATA

Table 1 - Upper Souhegan Annual Deficits (1946-1975, 2002-2012)

| Year | Annual deficit (cfs) | Annual deficit (cfsm)* | Annual deficit (ac-ft) |
|---|---|---|---|
| 1957 | 7.3 | 0.0707 | 28.9 |
| 1963 | 10.9 | 0.1054 | 43.1 |
| 1964 | 41.6 | 0.4043 | 165.2 |
| 1965 | 65.3 | 0.6344 | 259.2 |
| 1966 | 28.5 | 0.2762 | 112.9 |
| 1967 | 9.3 | 0.0905 | 37.0 |
| 1968 | 18.4 | 0.1782 | 72.8 |
| 2002 | 11.9 | 0.1158 | 47.3 |
| 2010 | 12.3 | 0.1197 | 48.9 |
| 2012 | 12.3 | 0.1197 | 48.9 |
| * Relative to USGS gage Souhegan R. Near Milford | | | |
| | = drought years of 1963-1966 | | |
| | = assessment results of 2002-2012 | | |
| Maximum all years | | 259.2 | ac-ft |
| Non drought years | | 72.8 | ac-ft |
| | | | |
| 90th percentile all years | | 202.8 | ac-ft |
| Non drought years | | 65.6 | ac-ft |
| | | | |
| plus 20% all years | | 243.3 | ac-ft |
| Non drought years | | 78.8 | ac-ft |

Table 2 - Upper Souhegan individual deficit events by Bioperiod (BP)

| Bioperiod | year | deficit (cfs) | deficit+20% (cfs) | deficit (ac-ft) | deficit (ac-ft) + 20% |
|---|---|---|---|---|---|
| BP 1 | 1965 | 18.6 | 22.3 | 73.6 | 88.3 |
| BP 1 | 1965 | 13.1 | 15.8 | 52.1 | 62.5 |
| BP 1 | 1965 | 9.5 | 11.4 | 37.8 | 45.3 |
| BP 1 | 1965 | 11.3 | 13.6 | 44.9 | 53.9 |
| BP 1 | 1966 | 14.3 | 17.1 | 56.6 | 67.9 |
| BP 1 | 2002 | 11.9 | 14.3 | 47.3 | 56.8 |
| BP 2 | 1967 | 9.3 | 11.2 | 37.0 | 44.4 |
| BP 2 | 1968 | 18.4 | 22.0 | 72.8 | 87.4 |
| BP 2 | 2012 | 12.3 | 14.8 | 48.9 | 58.7 |
| BP 3 | 1964 | 31.7 | 38.0 | 125.7 | 150.8 |
| BP4 | -- | -- | -- | -- | -- |
| BP5 | 1957 | 7.3 | 8.7 | 28.9 | 34.7 |
| BP5 | 1963 | 7.9 | 9.5 | 31.3 | 37.5 |
| BP5 | 1963 | 2.4 | 2.8 | 9.4 | 11.3 |
| BP5 | 1964 | 3.7 | 4.4 | 14.6 | 17.5 |
| BP5 | 1964 | 3.0 | 3.6 | 11.8 | 14.1 |
| BP5 | 1965 | 6.5 | 7.8 | 25.9 | 31.1 |
| BP5 | 1965 | 6.3 | 7.5 | 24.9 | 29.9 |
| BP5 | 1966 | 6.9 | 8.3 | 27.6 | 33.1 |
| BP5 | 1966 | 7.2 | 8.7 | 28.8 | 34.5 |
| BP5 | 2010 | 12.3 | 14.8 | 48.9 | 58.7 |
| BP6 | -- | -- | -- | -- | -- |
| | = drought years of 1963-1966 | | | | |
| | = assessment results of 2002-2012 | | | | |

Table 3 - Upper Souhegan bioperiod release values

| Upper Souhegan | | | | | | |
|---|---|---|---|---|---|---|
| **Bioperiod** | **Bioperiod name** | **Start** | **End** | **Volume of 90 percentile of historical deficits* (ac-ft)** | **Release volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)** | **Two-day flow release (cfs)** |
| 1 | Overwintering | 15-Nov | 28-Feb | 47.3 | 56.8 | 14.3 |
| 2 | Spring Flood | 1-Mar | 30-Apr | 48.9 | 58.7 | 14.8 |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 28.9 | 34.7 | 8.7 |
| 6 | Salmon Spawning | 1-Oct | 14-Nov | -- | -- | -- |

-- Release flow management currently too rare to define release flows.
* Based on maximum value or second to maximum value when available of individual deficit values from 1946-1975, 2002-2012.

Table 4 - Lower Souhegan annual deficits (1946-1975, 2002-2012)

| Year | Annual deficit (cfs) | Annual deficit (cfsm)* | Annual deficit (ac-ft) |
|---|---|---|---|
| 1947 | 22.7 | 0.1325 | 89.9 |
| 1948 | 22.3 | 0.1306 | 88.6 |
| 1949 | 12.3 | 0.0721 | 48.9 |
| 1950 | 11.8 | 0.0688 | 46.7 |
| 1952 | 68.8 | 0.4021 | 272.8 |
| 1953 | 24.7 | 0.1442 | 97.8 |
| 1956 | 55.8 | 0.3261 | 221.2 |
| 1957 | 49.7 | 0.2904 | 197.0 |
| 1958 | 14.3 | 0.0838 | 56.8 |
| 1962 | 10.0 | 0.0585 | 39.7 |
| 1963 | 91.7 | 0.5360 | 363.6 |
| 1964 | 144.4 | 0.8444 | 572.8 |
| 1965 | 166.0 | 0.9705 | 658.4 |
| 1966 | 112.0 | 0.6549 | 444.3 |
| 1968 | 55.8 | 0.3261 | 221.2 |
| 1969 | 11.3 | 0.0663 | 44.9 |
| 1970 | 17.3 | 0.1013 | 68.7 |
| 2002 | 28.3 | 0.1657 | 112.4 |
| 2010 | 21.8 | 0.1275 | 86.5 |
| 2012 | 37.0 | 0.2164 | 146.8 |
| * Relative to USGS gage Souhegan R at Merrimack | | | |
| | = drought years of 1963-1966 | | |
| | = assessment results of 2002-2012 | | |
| Maximum all years | | 658.4 | ac-ft |
| Non drought years | | 272.8 | ac-ft |
| | | | |
| 90th percentile all years | | 457.1 | ac-ft |
| Non drought years | | 221.2 | ac-ft |
| | | | |
| plus 20% all years | | 548.5 | ac-ft |
| Non drought years | | 265.4 | ac-ft |

Table 5 - Lower Souhegan individual events by Bioperiod (BP)

| Bioperiod | year | deficit (cfs) | deficit+20% (cfs) | deficit (ac-ft) | deficit (ac-ft) + 20% |
|---|---|---|---|---|---|
| BP 1 | 1965 | 31.0 | 37.2 | 123.0 | 147.6 |
| BP 1 | 1965 | 22.0 | 26.4 | 87.3 | 104.7 |
| BP 1 | 1965 | 16.0 | 19.2 | 63.5 | 76.2 |
| BP 1 | 1965 | 19.0 | 22.8 | 75.4 | 90.4 |
| BP 1 | 1966 | 25.0 | 30 | 99.2 | 119.0 |
| BP 1 | 2002 | 8.0 | 9.6 | 31.7 | 38.1 |
| BP 2* | 2012 | 37.0 | 44.4 | 146.8 | 176.1 |
| BP3 | 1963 | 29.0 | 34.8 | 115.0 | 138.0 |
| BP3 | 1964 | 38.0 | 45.6 | 150.7 | 180.9 |
| BP4 | -- | -- | -- | -- | -- |
| BP5 | 1957 | 8.0 | 9.6 | 31.7 | 38.1 |
| BP5 | 1957 | 10.0 | 12 | 39.7 | 47.6 |
| BP5 | 1962 | 10.0 | 12 | 39.7 | 47.6 |
| BP5 | 1948 | 6.0 | 7.2 | 23.8 | 28.6 |
| BP5 | 1963 | 9.0 | 10.8 | 35.7 | 42.8 |
| BP5 | 1963 | 5.0 | 6 | 19.8 | 23.8 |
| BP5 | 1963 | 6.0 | 7.2 | 23.8 | 28.6 |
| BP5 | 1964 | 12.0 | 14.4 | 47.6 | 57.1 |
| BP5 | 1964 | 12.0 | 14.4 | 47.6 | 57.1 |
| BP5 | 1964 | 8.4 | 10.08 | 33.3 | 40.0 |
| BP5 | 1964 | 5.0 | 6 | 19.8 | 23.8 |
| BP5 | 1965 | 12.3 | 14.76 | 48.8 | 58.6 |
| BP5 | 1965 | 12.0 | 14.4 | 47.6 | 57.1 |
| BP5 | 1965 | 12.5 | 15 | 49.6 | 59.5 |
| BP5 | 1965 | 12.5 | 15 | 49.6 | 59.5 |
| BP5 | 1966 | 15.0 | 18 | 59.5 | 71.4 |
| BP5 | 1966 | 11.6 | 13.92 | 46.0 | 55.2 |
| BP5 | 1966 | 10.4 | 12.48 | 41.3 | 49.5 |
| BP5 | 2010 | 16.8 | 20.16 | 66.6 | 80.0 |
| BP5 | 2010 | 5.0 | 6 | 19.8 | 23.8 |
| BP6 rev | 1947 | 11.3 | 13.596 | 44.9 | 53.9 |
| BP6 rev | 1947 | 11.3 | 13.596 | 44.9 | 53.9 |
| BP6 rev | 1948 | 16.3 | 19.596 | 64.8 | 77.7 |
| BP6 rev | 1949 | 12.3 | 14.796 | 48.9 | 58.7 |
| BP6 rev | 1950 | 11.8 | 14.112 | 46.7 | 56.0 |
| BP6 rev | 1952 | 68.8 | 82.512 | 272.8 | 327.3 |
| BP6 rev | 1953 | 7.3 | 8.796 | 29.1 | 34.9 |
| BP6 rev | 1953 | 17.3 | 20.796 | 68.7 | 82.5 |

| | | | | | |
|---|---|---|---|---|---|
| BP6 rev | 1956 | 55.8 | 66.912 | 221.2 | 265.4 |
| BP6 rev | 1957 | 17.3 | 20.796 | 68.7 | 82.5 |
| BP6 rev | 1957 | 14.3 | 17.196 | 56.8 | 68.2 |
| BP6 rev | 1958 | 14.3 | 17.196 | 56.8 | 68.2 |
| BP6 rev | 1963 | 21.3 | 25.596 | 84.6 | 101.5 |
| BP6 rev | 1963 | 21.3 | 25.596 | 84.6 | 101.5 |
| BP6 rev | 1964 | 26.3 | 31.596 | 104.4 | 125.3 |
| BP6 rev | 1964 | 15.3 | 18.396 | 60.8 | 73.0 |
| BP6 rev | 1964 | 27.3 | 32.796 | 108.4 | 130.1 |
| BP6 rev | 1965 | 18.3 | 21.996 | 72.7 | 87.3 |
| BP6 rev | 1965 | 10.3 | 12.396 | 41.0 | 49.2 |
| BP6 rev | 1966 | 21.3 | 25.596 | 84.6 | 101.5 |
| BP6 rev | 1968 | 55.8 | 66.912 | 221.2 | 265.4 |
| BP6 rev | 1969 | 11.3 | 13.596 | 44.9 | 53.9 |
| BP6 rev | 1970 | 17.3 | 20.796 | 68.7 | 82.5 |
| | = drought years of 1963-1966 | | | | |
| | = assessment results of 2002-2012 | | | | |

*Spring (BP2) 2012 was an unprecedented drought year with new daily minimums occurring over several days to weeks.

Table 6 - Lower Souhegan bioperiod release values

| Lower Souhegan | | | | | | |
|---|---|---|---|---|---|---|
| **Bioperiod** | **Bioperiod name** | **Start** | **End** | **Volume of 90 percentile of historical deficits * (ac-ft)** | **Release volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)** | **Two-day flow release (cfs)** |
| 1 | Overwintering | 15-Nov | 28-Feb | 31.7 | 38.1 | 9.6 |
| 2 | Spring Flood | 1-Mar | 30-Apr | -- | -- | -- |
| 3 | Clupeid Spawning | 1-May | 14-Jun | -- | -- | -- |
| 4 | GRAF Spawning | 15-Jun | 14-Jul | -- | -- | -- |
| 5 | Rearing & Growth | 15-Jul | 30-Sep | 27.0 | 32.4 | 8.2 |
| 6 revised | Salmon Spawning | 1-Oct | 14-Nov | 73.5 | 88.2 | 22.2 |

-- Release flow management currently too rare to define release flows.

*Based on 90th percentile of individual deficit values from 1946-1975, 2002-2012, except BP1 where maximum deficit value was applied.

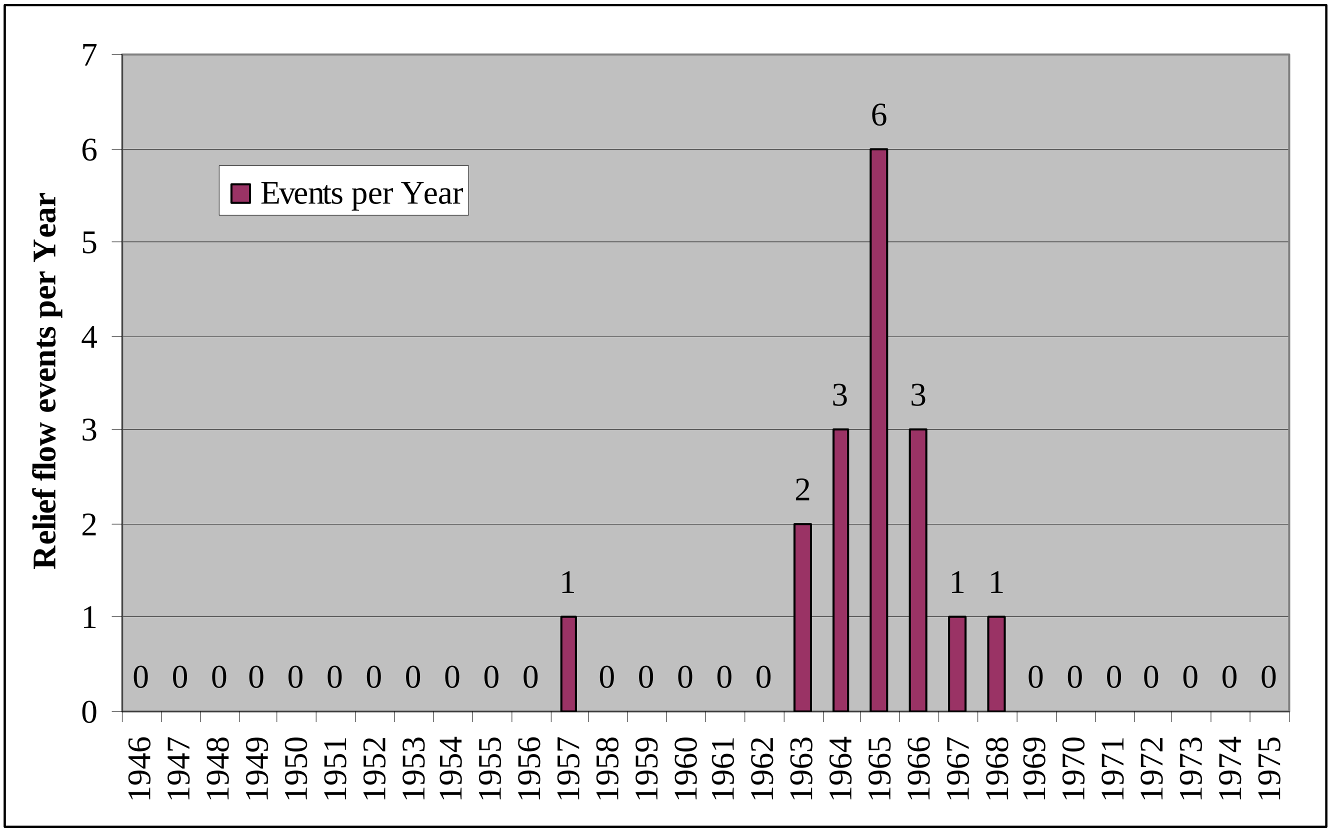



Figure 1 – Upper Souhegan River - Catastrophic events per year (1946-1975)

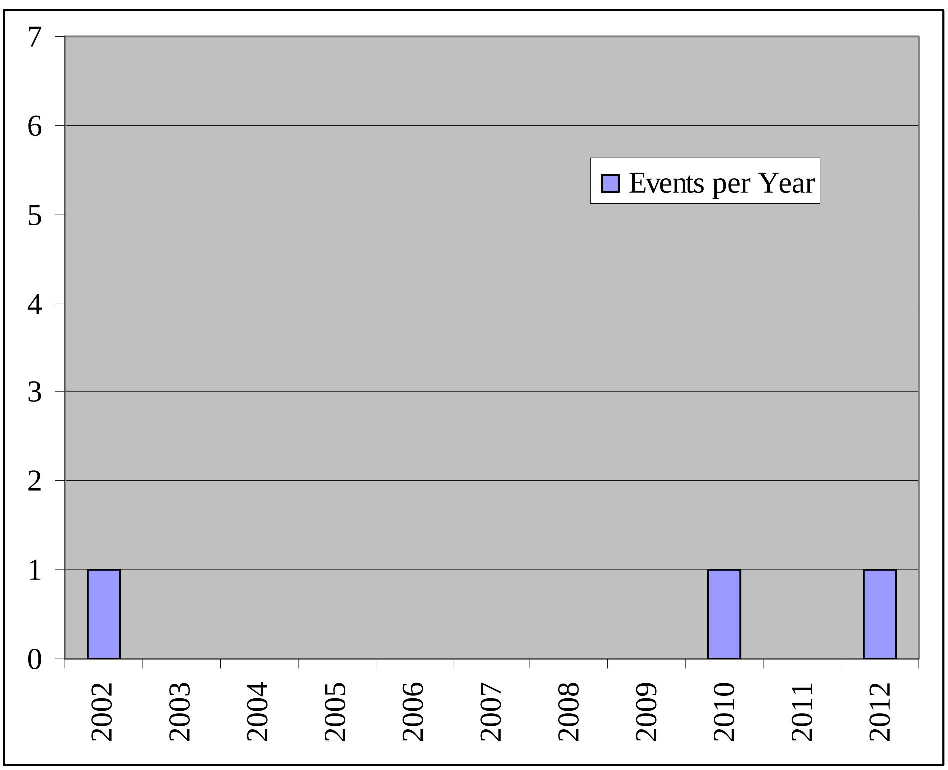



Figure 2 - Upper Souhegan River - Catastrophic events per year (2002-2012)

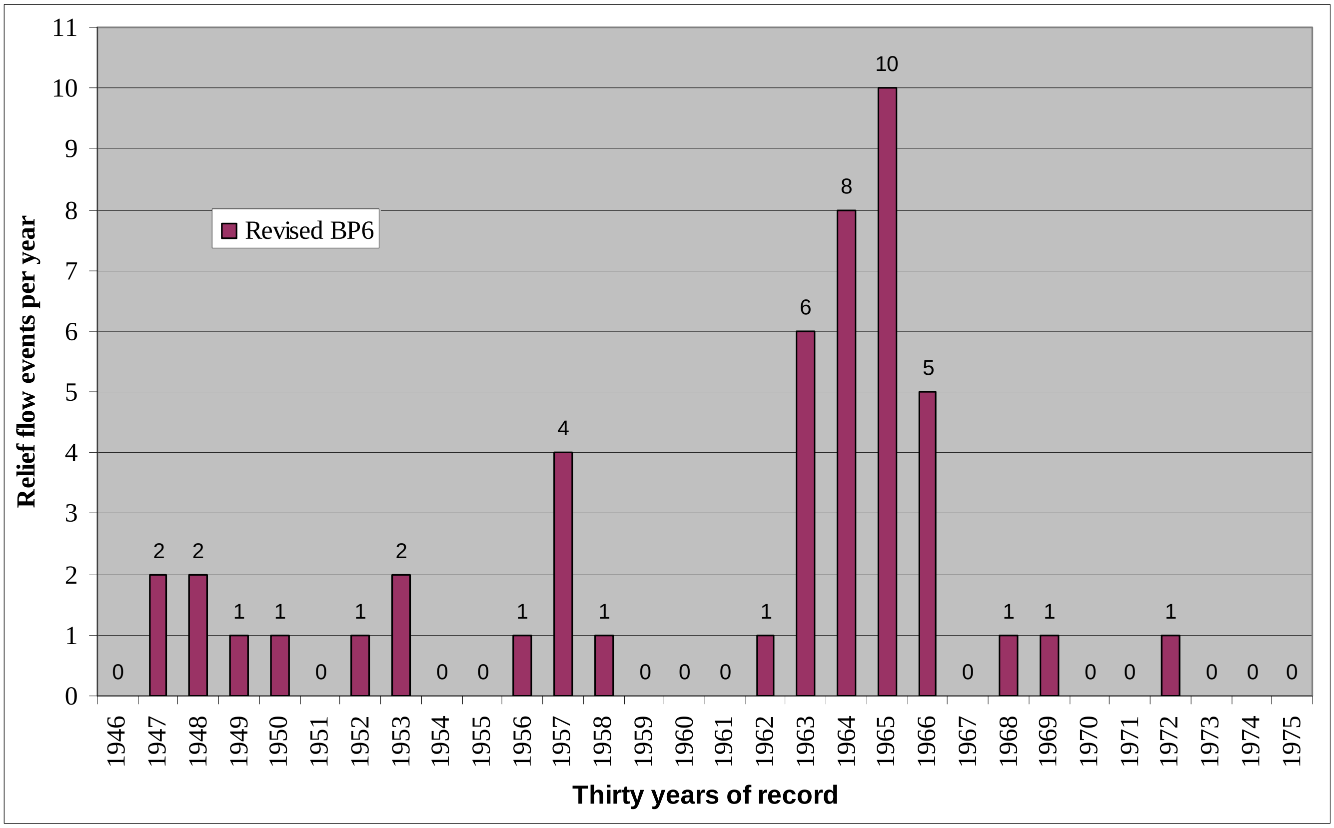



Figure 3 - Lower Souhegan River - Catastrophic events per year (1946-1975)

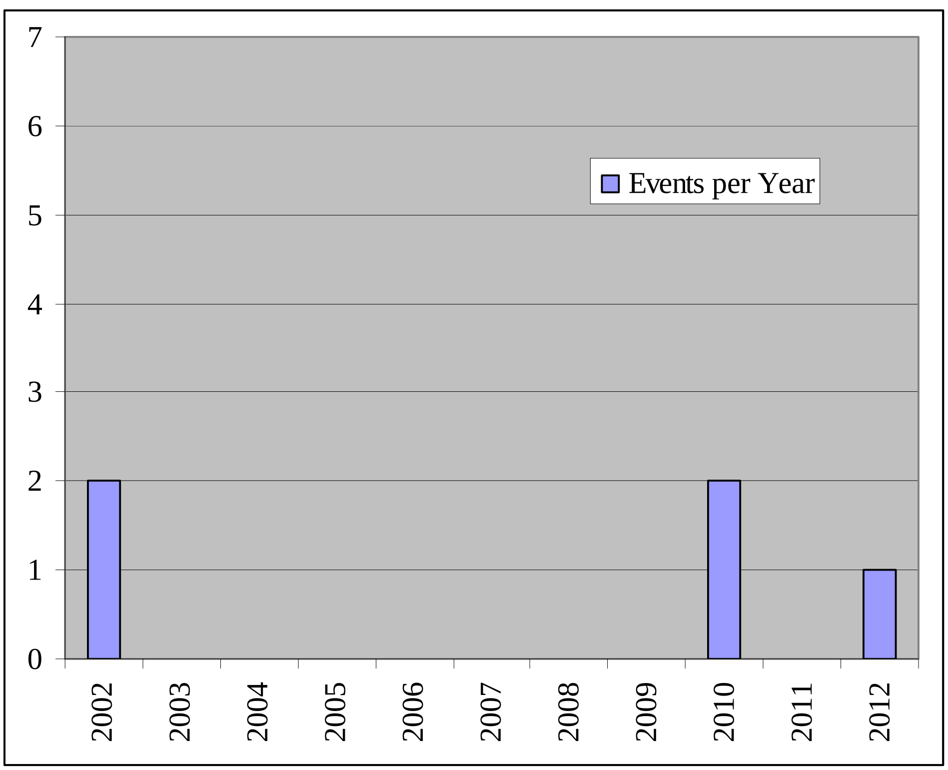



Figure 4 - Lower Souhegan River - Catastrophic events per year (2002-2012)

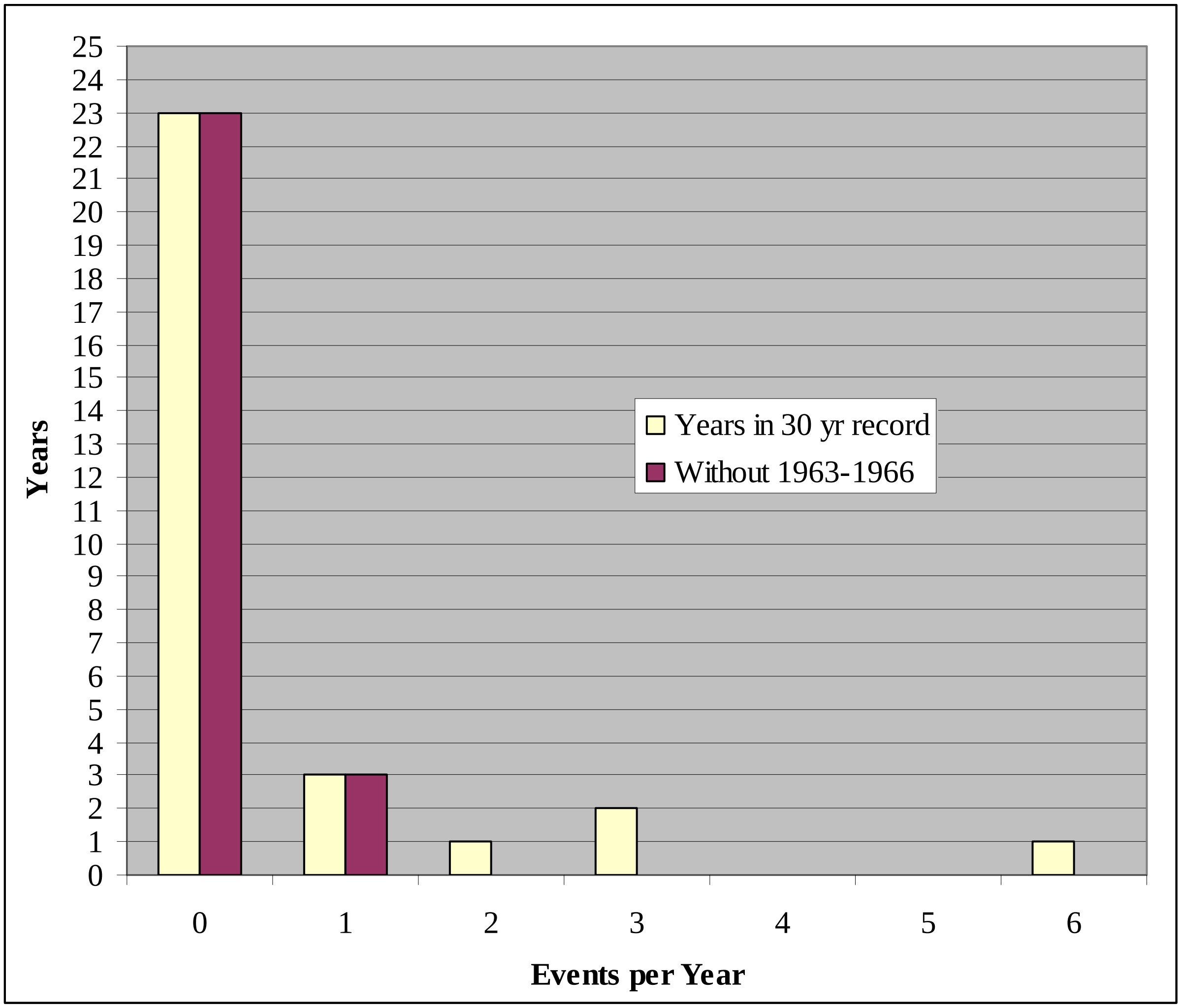



Figure 5 – Frequency of Catastrophic events per year - Upper Souhegan (1946-1975)

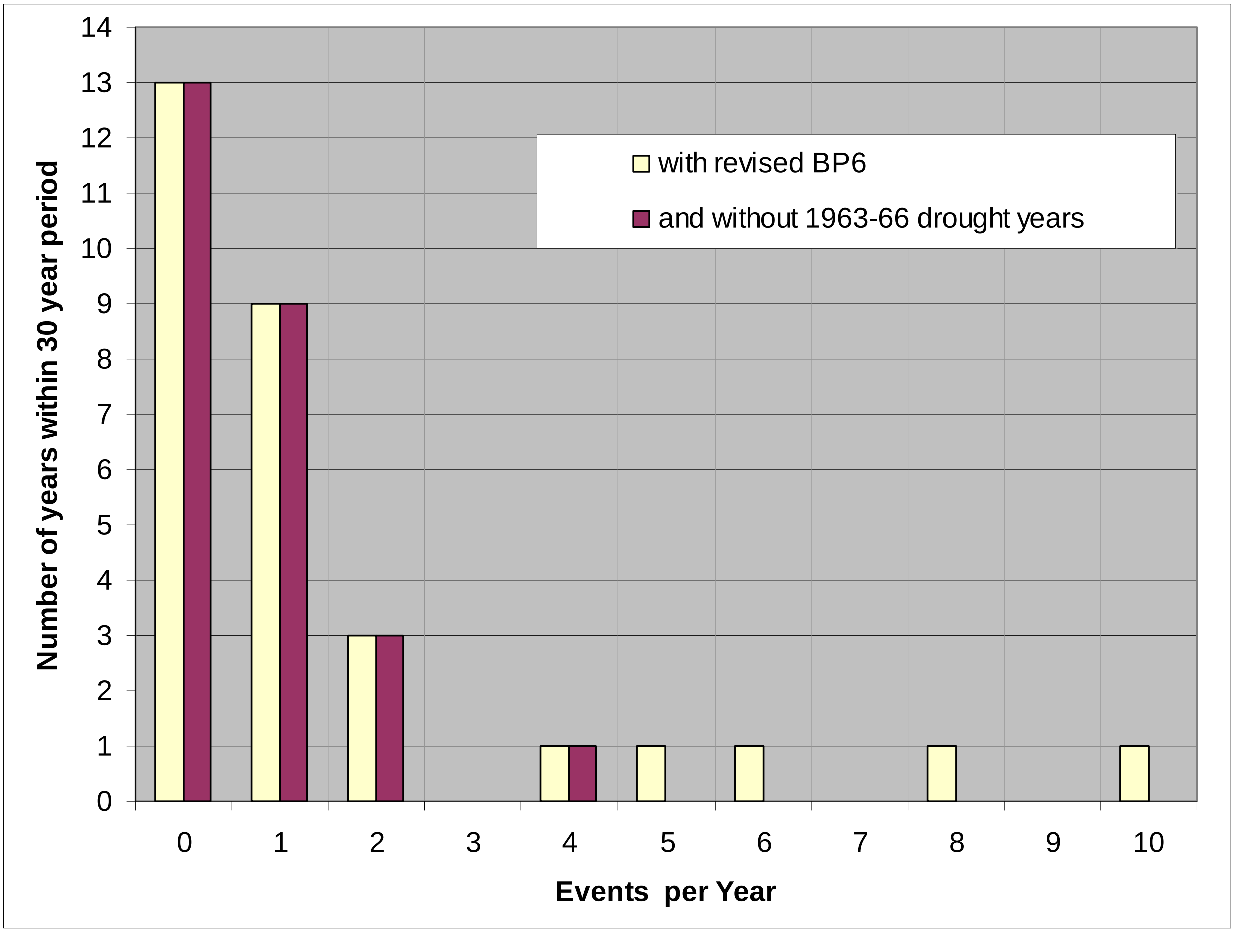



Figure 6 – Frequency of Catastrophic events per year - Lower Souhegan (1946-1975)

# Appendix F

# Financial Assistance Summary Table

# Souhegan River Water Management Plan

**August 2013**

| NHDES Instream Flow Program Potential Funding Sources for Affected Water Users (as of June 2010) | | | | | | |
|---|---|---|---|---|---|---|
| **Applicable Water Users** | **Funding Source** | **Funding Type** | **Amount Available for 2010** | **Application Date** | **Detail** | **Contact Information** |
| Agriculture | USDA, Natural Resources Conservation Services (NRCS), Conservation Stewardship Program (CSP). | Grant, no match required. | $1,000 to $40,000 annually per person/entity. | Annually | Through CSP, NRCS will provide financial and technical assistance to eligible producers **to conserve and enhance** soil, **water,** air, and related natural resources on their land on which resource concerns related to agricultural production could be addressed. | NH NRCS State Office Federal Building, 2 Madbury Road, Durham, NH 03824-2043; 603-868-7581 |
| Agriculture | USDA, Natural Resources Conservation Services, Conservation Innovation Grant (CIG) | Grant, 50% non-federal match required. | $80,000 to $168,000 available annually in NH. Up to $75,000 per person/entity. | Annually | Conservation Innovation Grants (CIG) is a voluntary program intended to stimulate the development and **adoption of innovative conservation approaches and technologies** while leveraging Federal investment in environmental enhancement and protection, in conjunction with agricultural production. Under CIG, Environmental Quality Incentives Program (EQIP) funds are used to award competitive grants to non-Federal governmental or non-governmental organizations, Tribes, or individuals. | NH NRCS State Office Federal Building, 2 Madbury Road, Durham, NH 03824-2043; 603-868-7581 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Agriculture | USDA, Natural Resources Conservation Services, Agricultural Management Assistance (AMA) | Grant, 25% match required. | Up to $50,000 per person/entity annually. | Unknown | Agricultural Management Assistance (AMA) provides cost share assistance to agricultural producers **to voluntarily address issues such as water management, water quality**, and erosion control by incorporating conservation into their farming operations. **Producers may construct or improve water management structures or irrigation structures**; plant trees for windbreaks or improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. | NH NRCS State Office Federal Building, 2 Madbury Road, Durham, NH 03824-2043; 603-868-7581 |
| Varied | NH Dept. of Environmental Services (DES), Watershed Assistance Section, Nonpoint Source Local Initiatives Grants (Section 319 Grants) | Grant, 40% non-federal match required | | Annually | For watershed management efforts. Grants given to associations, organizations, agencies. | Eric Williams, 29 Hazen Drive, Concord, NH 03301, (603) 271-2358, eric.williams@des.nh.gov |

| | | | | | | |
|---|---|---|---|---|---|---|
| Varied | NH Dept. of Environmental Services (DES), Watershed Assistance Section, Watershed Restoration Grants (Section 319 Restoration Grants) | Grant, 40% non-federal match required | | Annually | Grants can be given to farmers, watershed associations, conservation districts, non-profit organizations, regional planning agencies, and municipalities to implement practices that help restore impaired waters. | Eric Williams, 29 Hazen Drive, Concord, NH 03301, (603) 271-2358, eric.williams@des.nh.gov |
| Water Suppliers | NH Dept. of Environmental Services (DES), Drinking Water & Groundwater Bureau, Local Source Water Protection Grants (Drinking Water Source Protection) | Grant. No match is required, but projects receive higher ranking for local match funds. | Up to $20,000 per project. | Annually | To protect public drinking water sources. Water suppliers, municipalities, conservation districts, and non-profits can apply. | Johanna McKenna 29 Hazen Drive, Concord, NH 03301, (603) 271-7017, johanna.mckenna@des.nh.gov |
| Varied | NH State Conservation Committee, Moose Plate Conservation Grants | Grant. Two tiers of under $5,000 and over $5,000 projects. | $200,000 available in 2009. Varies based on Moose Plate sales and | Annually | Conservation Grants shall be made available for planning and carrying out projects that enhance New Hampshire's environment by promoting the sustainability of the state's public and private land, air, and water resources to prevent their pollution or | Dea Brickner-Wood, Grants Administrator, at 603.868.6112 or via email at bluesky24@com |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | No match required, but encouraged. | renewals | | degradation | cast.net |
| Varied | NH Dept. of Environmental Services, Lakes and Rivers Programs, Water Quality Planning Grants (604b Grants) | Grant. No match is required. | Up to $80,000 available annually. Projects usually only awarded up to $20,000 per Regional Planning Commission. | Annually | These grants are available to Regional Planning Commissions and/or the Connecticut River Joint Commissions for water quality planning purposes. Funding priority is given to projects developing and implementing river corridor/ river watershed plans. | Laura Weit-Marcum 29 Hazen Drive, Concord, NH 0330, 603-271-8811, laura.weit-marcum@des.nh.gov |
| Recreation | NH Dept. of Resources and Economic Development (DRED), Land and Water Conservation Fund Program | Grant, 50% non-federal match required | Unknown | Annually | The Land and Water Conservation Fund (LWCF) was enacted to create and maintain a nationwide legacy of high quality, outdoor recreation areas and facilities. Emphasis for awarding LWCF grants is placed on projects with the greatest possible impact – projects that: cover a broad geographic scope, include service to special needs populations, increase recreational areas and facilities, protect critical natural or cultural resources, and provide access to water-based, public recreation opportunities. | Gail Wolek, DRED - Division of Parks and Recreation, PO Box 1856, Concord, NH 03302-1856, 603-271-3556 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Public Water Systems | NH Dept. of Environmental Services, Drinking Water and Groundwater Bureau, Record Drawing Grant Program | Grant, 50% match required. | Up to $1,500 per water system | Annually | The New Hampshire Department of Environmental Services (DES) is pleased to announce the Public Water System Record Drawing Grant program. This grant is intended to assist small community water systems prepare or update your record drawings (a.k.a. as builts), to accurately reflect the location of critical system infrastructure, especially underground facilities. | Susan Willoughby, 29 Hazen Drive, Concord, NH 03301, 603-271-5447, susan.willoughby@des.nh.gov |
| Public Water Systems | NH Dept. of Environmental Services, Drinking Water and Groundwater Bureau, Capacity Assurance Program-Regional Water System Grant | Grant, 75% match required | Unknown | Annually | This grant program provides 25 percent reimbursement of costs for planning, design and construction of piping, pumping, and source improvements associated with interconnection of two or more public water systems. | |
| Varied | NH Land and Community Heritage Investment Program (LCHIP) | Grant, 50% match required. | None for 2010. Funds availability varies annually based on state budget allocation. | None | Eligible applicants may apply for grant funds for the protection of natural resources, including riverine, lakes, farmland, and existing a potential water supply land for resource inventories and planning that can demonstrate linkage to the permanent protection of eligible resources; | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Varied | USDA, Natural Resources Conservation Service, Watershed Surveys and Planning Program | Unknown | None for 2010. | None | This appropriation supports and benefits the NRCS Mission Goal of Clean and Abundant Water in two ways. First, the funds help improve and maintain surface waters and ground water to protect human health, support a healthy environment, and encourage a productive landscape. Second, the program funds help conserve and protect water to ensure a reliable water supply for the Nation. | NH NRCS State Office Federal Building, 2 Madbury Road, Durham, NH 03824-2043; 603-868-7581 |
| Water Suppliers | NH Dept. of Environmental Services, Drinking Water and Groundwater Bureau, Drinking Water State Revolving Fund | Loan | Approximately $9 million available annually with 1-3% interest rates between 5-20 year periods. | | The Drinking Water State Revolving Fund (DWSRF) was created to provide assistance in the form of low interest loans to public water systems to finance the cost of drinking water infrastructure. Public water systems eligible for this program include all community public water systems and non-transient non-profit public water systems. In addition, funds are used to promote proactive drinking water measures such as source water protection, operator certification, small system technical assistance/capacity development, and program administration. | Dave Kelly, 29 Hazen Drive, Concord, NH 03301, 603-271-2472, david.kelly@des.nh.gov |
| Snowmaking Operations | National Ski Area Association (NSAA), Sustainable Slopes Grant | Grant | Up to $20,000 for 2-3 projects demonstrating merit and financial need. | Annually | The Environmental Charter, commonly known as Sustainable Slopes, was adopted in June 2000 and revised in 2006 as a collection of environmental best practices for ski area owners and operators (visit www.nsaa.org for information on the Environmental Charter). The purpose of the new Sustainability Grant Program is to spark innovation and increase resorts' | THE BRENDLE GROUP, INC. (970) 207-0058/FAX (970) 207-0059 226 S. Remington St., #3 Fort Collins, CO |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | progress in implementing the Environmental Principles of the Charter. Projects under this grant include water use for snowmaking and water quality management activities. | 80524 jdorsey@brendlegroup.com http://www.nsaa.org/nsaa/environment |
| Varied | NH Dept. of Environmental Services, Wetlands Bureau, Aquatic Resources Mitigation Program | Grant. No match required, but encouraged. | Varies based on in-lieu fees collected by watershed. | Varied by Watershed. | The DES Aquatic Resource Mitigation (ARM) Fund provides an in-lieu fee payment alternative for permit applicants to consider when striving to meet state and federal wetland mitigation requirements. Grants are offered for activities that restore or protect aquatic resources, including but not limited to the following:<br><br>1) Development of final wetland restoration, enhancement, or creation plans.<br>2) Construction costs for wetland restoration, enhancement, or creation such as site clearing and excavation, construction management, consulting fees, permit costs, wetland grading and soil augmentation, disposal costs of excavated materials, planting, and monitoring and maintenance of wetland restoration or creation sites to reduce risk of failure.<br>3) Acquisition of land or conservation easements that help protect high conservation value wetlands in perpetuity and associated costs including property surveys, appraisals, legal costs, closing costs, and subdivision fees. | Lori Sommer, Wetlands Bureau PO Box 95 Concord, NH 03302-0095(603) 271-4059 or lori.sommer@des.nh.gov. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | 4) Acquisition of conservation interests after a qualified grantee has been identified.<br>5) Stewardship of a conservation interest.<br>6) Other aquatic resource improvement or protection projects, such as water quality improvement projects, tidal wetland restoration projects, dam removal projects, stream or river restoration projects, or activities that provide habitat improvement including culvert replacement or removal. | |

# Appendix G

# Souhegan River Water Elevation Evaluation
# April 2009

## Souhegan River Water Management Plan

## August 2013

# SOUHEGAN RIVER WATER ELEVATION EVALUATION

APRIL 2009

# SOUHEGAN RIVER WATER ELEVATION EVALUATION

*Prepared for*
**New Hampshire Department of Environmental Services**
**Hazen Drive**
**Concord, NH**

*Prepared by*
**NORMANDEAU ASSOCIATES, INC.**
**25 Nashua Road**
**Bedford, NH 03110**

**R-199152.000**

**April 2009**

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# 1.0 SOUHEGAN RIVER WATER ELEVATION EVALUATION OF SITES 19 AND 35

## 1.1 INTRODUCTION

Normandeau Associates, Inc. (Normandeau) has evaluated the potential environmental impacts of elevated water levels at two of the state-owned dams on the Souhegan River, Site 19 and Site 35, as partial fulfillment of the New Hampshire Department of Environmental Services (DES) Souhegan River Protected Instream Flow Study (PISF) and subsequent development of a Water Management Plan (WMP). Both dams at Site 19 and Site 35 were chosen for evaluation due to their potential for use in future flow augmentation; based on their fulfilling several criteria, notably state ownership of the dams, their storage capacity and the potential for the modification of their current operating regime. Holding water at these impoundments longer into the summer season could allow for release later in the late summer/early fall to augment flows during low water months or drought conditions.

The significant potential environmental impacts that could occur from this action would be to the wetlands and uplands adjacent to the impoundments. Normandeau reviewed the following listed information in this exercise: National Wetland Inventory (NWI) maps via the Fish and Wildlife Service online mapping tool, aerial photos from TerraServer Imagery, soil maps from Natural Resources Conservation Service (NRCS) Web Soil Survey, and New Hampshire GRANIT ArcGIS which included aerial photos, topography and wetland layers, and maps and water elevation data provided by DES.

Normandeau also conducted a search of the New Hampshire Natural Heritage Bureau (NHNHB) online database to determine potential impacts to federal- or state-listed Rare, Threatened or Endangered (RTE) species or Exemplary Natural Communities for both sites. No RTE species or species of special concern for wildlife or plants are known to occur in or near these impoundments. Species at the extremities of their ranges, critical habitat for migratory fish and wildlife or exemplary natural communities were also not recorded in the data base for these areas.

## 1.2 SITE 19

Site 19 is located in the Town of New Ipswich immediately south of the intersection of Ashburnham Road (Route 123) and Ashby Road. The dam and impoundment are located on the South Branch of the Souhegan River (Figure 1, location and topographic map). An unnamed stream enters the impoundment at the northwest corner. The impoundment is approximately 26 acres in size and approximately 2,400 feet in length at full pool and is elongated in shape, with the eastern boundary defined by the topographic feature of Whittemore Hill, 1370 feet in elevation. The areas adjacent to the impoundment to the northwest and south comprise a wetland complex associated with the South Branch and unnamed stream floodplains (Figure 2, NWI/GRANIT map). Both of these areas are wide, relatively flat, and defined by an increase in elevation to the west and south.

As shown on Figure 2, and listed in Table 1, the wetlands adjacent to the impoundment are complex and diverse and reflect the uneven nature of the underlying topography. A typical “bowl” impoundment would have a fringe of emergent wetlands, then scrub-shrub wetlands lying upslope of the waters edge, and then a forested wetland further upslope and away from the water. This system

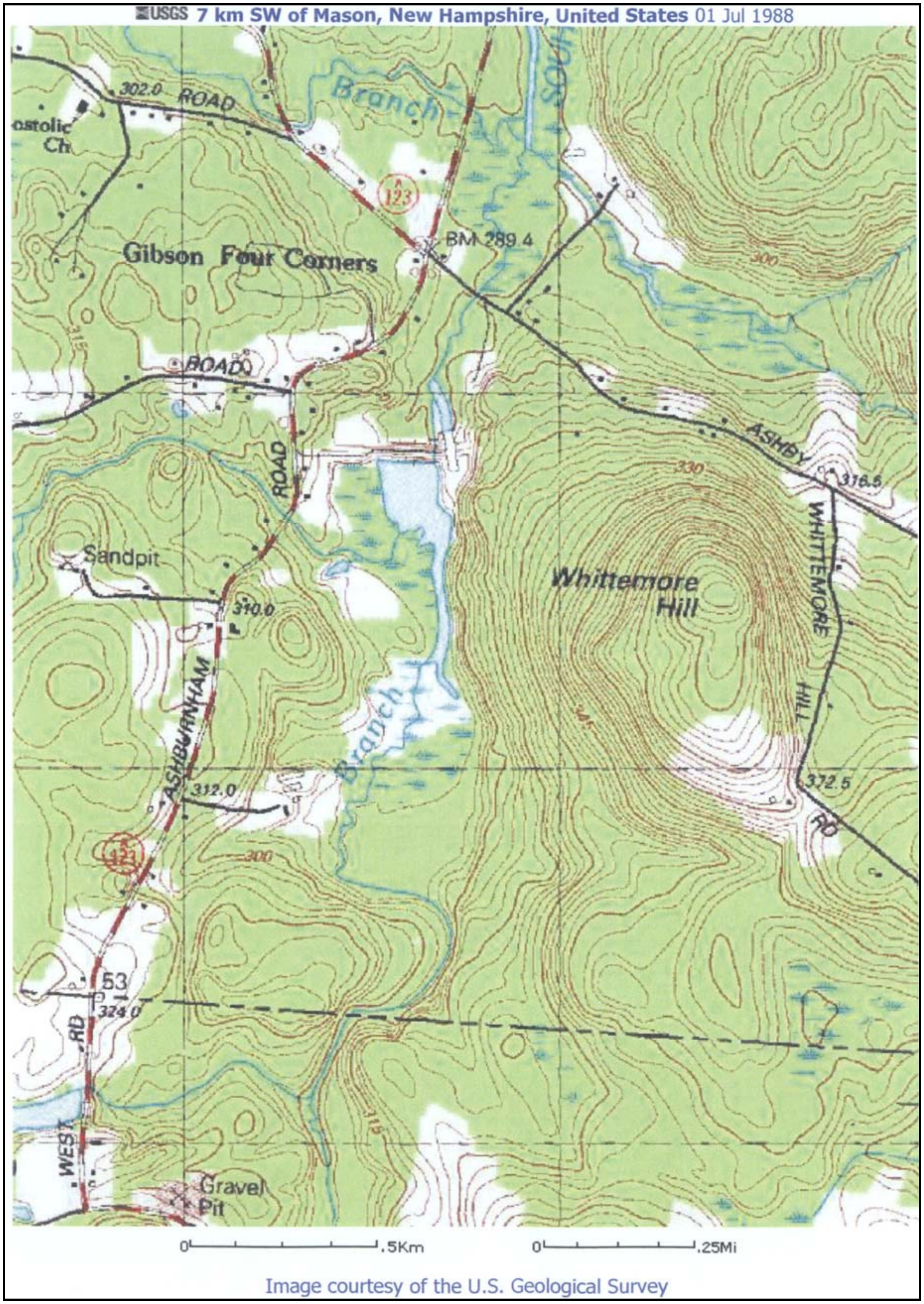


Figure 1. Site 19 topographic map.

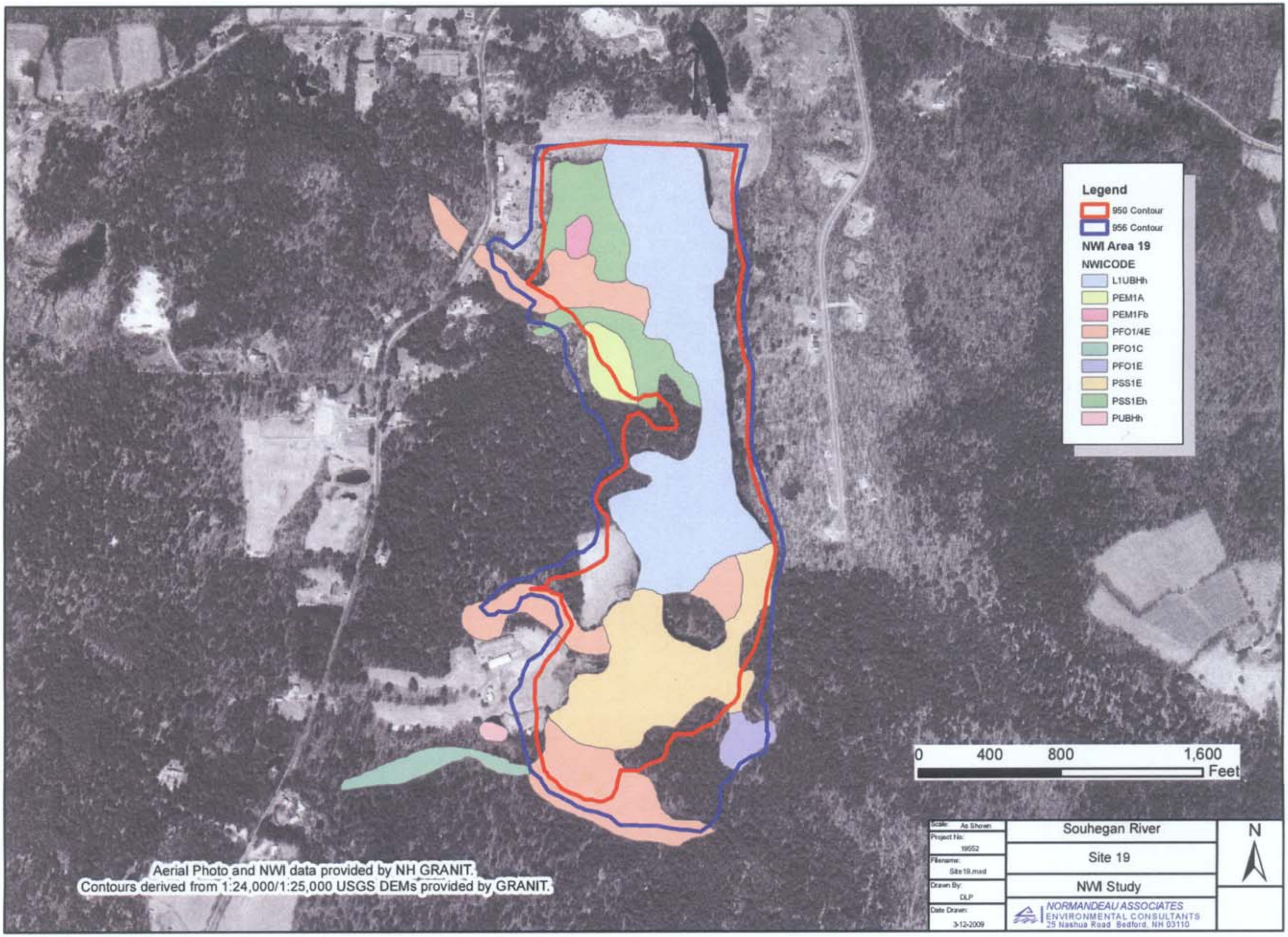


Figure 2. Site 19 NWI layer from GRANIT

contains a mix of emergent, forested and scrub-shrub wetlands. In the northwest corner an emergent wetland (PEM1FB, semi permanently flooded) is located quite a distance from the impoundment edge and is surrounded by a scrub-shrub wetland (PSS1Eh, impounded) to the north and a fairly linear forested wetland (PFO1/4E, seasonally flooded/saturated) to the south that reflects the riparian zone of the unnamed stream. South of this is more scrub-shrub wetland (PSS1Eh, impounded) adjacent to the impoundment, with a second emergent wetland (PEM1A, temporarily flooded) to the west. The location of the emergent wetlands away from the edge of the impoundment may indicate additional sources of water (tributary stream or beaver impoundment), topographic variability, or vegetation management. Soils are a mix of loamy sand, fine sandy loam and stony fine sandy loam (Figure 3). To the south, a large scrub-shrub wetland (PSS1E, seasonally flooded/saturated) follows the South Branch floodplain, with a small forested pocket of wetland (PFO1/4E) at the southeast edge of the impoundment and running further south along the floodplain and to the east following a break in the elevation and soils that may reflect an unmapped intermittent stream running off the small developed hill to the west. A forested wetland (PFO1C, seasonally flooded) also runs west off the southern edge of the forested wetland and a small forested pocket (PFO1E, seasonally flooded/saturated) exists in the southeast corner. All of these wetlands areas contain Rumney loam or fine sandy loam, and as noted when comparing the soil and wetland maps, the wetlands have developed to the maximum potential based on the underlying soils and regional elevation.

**Table 1. Souhegan River Dam Site 19 Wetlands**

| | Below Elev. 956 | | Below Elev. 950 | | Between 956 – 950 | |
|---|---|---|---|---|---|---|
| **NWI Wetland Code** | **ft** | **acres** | **ft** | **acres** | **ft** | **acres** |
| L1UBHh | 1144303 | 26.27 | 1144303 | 26.27 | 0 | 0.00 |
| PEM1A (temp fld) | 97214 | 2.23 | 58580 | 1.34 | 38634 | 0.89 |
| PEM1Fb (semiperm fld) | 28304 | 0.65 | 28304 | 0.65 | 0 | 0.00 |
| PFO1/4E (seas fld/sat) | 565074 | 12.97 | 365736 | 8.40 | 199338 | 4.58 |
| PFO1C (seas fld) | 245 | 0.01 | | 0.00 | 245 | 0.01 |
| PFO1E (seas fld/sat) | 57606 | 1.32 | | 0.00 | 57606 | 1.32 |
| PSS1E (seas fld/sat) | 612636 | 14.06 | 590752 | 13.56 | 21884 | 0.50 |
| PSS1Eh (impounded) | 348782 | 8.01 | 324760 | 7.46 | 24022 | 0.55 |
| **Total** | 1709861 | **39.25** | 1368132 | **31.41** | 341729 | **7.85** |

Figure 2 shows the approximate existing area of the impoundment, marked by the blue L1UBHh wetland designation, and the topographic contours of 950 foot and 956 foot have been located on the map in blue and red to show the proposed minimum and maximum levels of water that could be held in the impoundment for several months into the spring and summer. These contours were created from the 1:24,000 USGS Digital Elevation Models (DEMs) provided by GRANIT, which have a reduced accuracy for contours with less than a 20-foot interval. Thus, the contours were created for this exercise and can only be used for estimating areas. However, as Table 1 shows, the area of wetlands that would be under water at the 950 foot and 956 foot water levels is approximately 31.4 acres and 39.3 acres, respectively.

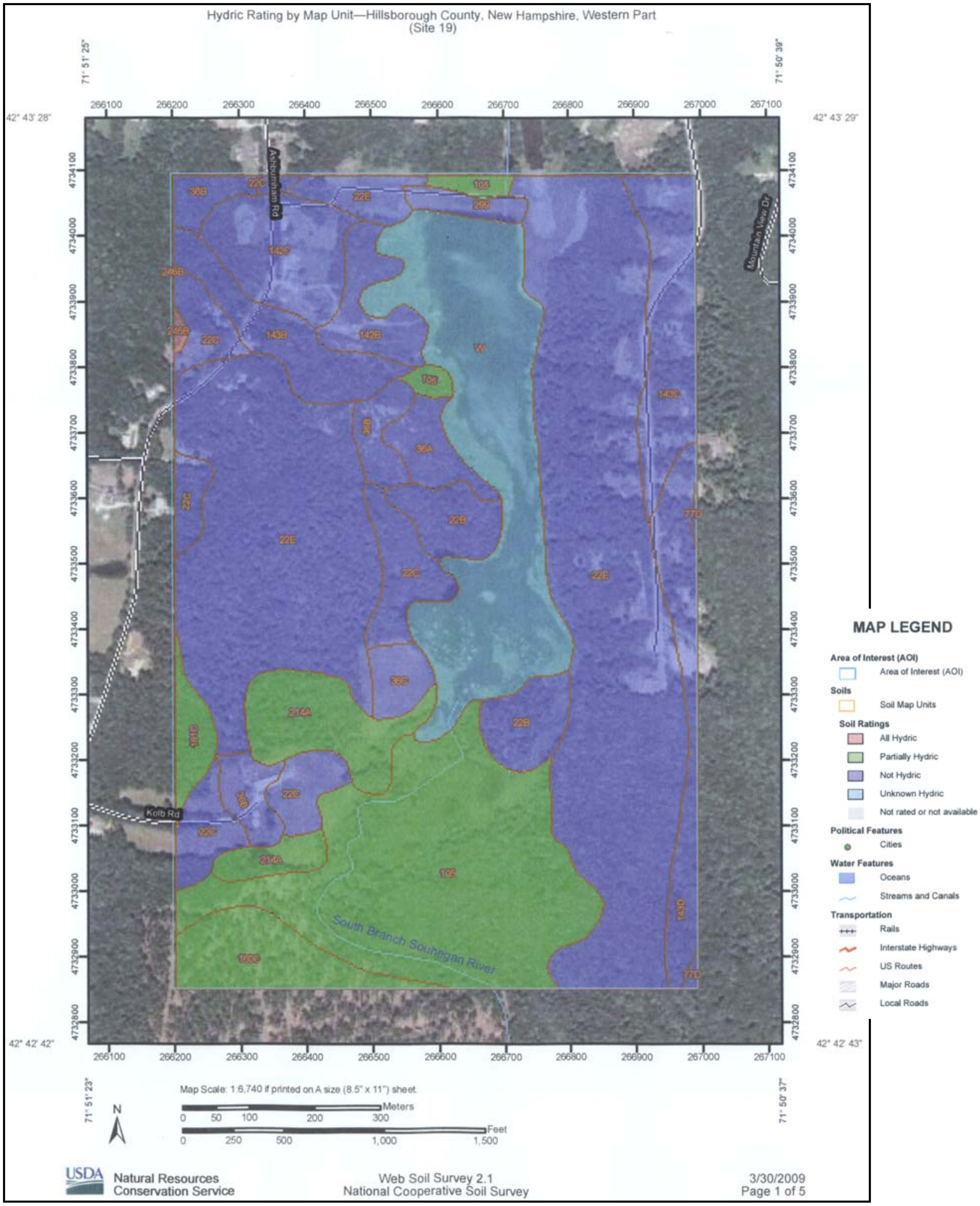


Figure 3. Site 19 NRCS soil map with hydric units

As previously stated, duration and timing of the water elevation changes will determine the nature of wetland impacts, and these are not precisely known. For estimating potential impacts, it was assumed that water levels would be higher than current levels by approximately 5-10 feet for most of the growing season. This range of water levels is based on the storage-elevation information for this site as provided by the NH Dam Bureau (Mattaini, personal communication). Using the approximate data from Table 1, the following predictions can be made:

1. The existing emergent marsh areas would be flooded, approximately 0.65 acres and 1.3 to 2.2 acres depending on the water level. These marshes typically contain plants such as burred, pickerelweed, and arrowhead - vegetation that is adapted to flooded conditions. Species composition may change due to the deeper water, and areas deeper than 6 inches may convert to open water or deep submergent and/or floating-leaved vegetation (Palustrine aquatic bed wetland).
2. Emergent wetlands are likely to increase in size, taking the place of the larger scrub-shrub and forested wetlands as water levels increase.
3. The scrub-shrub wetlands to the north, approximately 7.5 to 8 acres, may decrease in size depending on the species composition and water depth; as noted above, some areas will transition to emergent marsh as the less flood-tolerant species drown and are replaced.
4. The forested wetlands, approximately 8.5 to 13 acres, would see the largest net change in area. Trees within portions of the existing forested wetlands would succumb to prolonged flooding within a few years, and emergent and scrub-shrub wetlands (PEM1, PSS1) would become established where water is at or near the surface during the growing season. Vegetation dominance would shift from facultative wetland trees and herbs to obligate wetland shrub and emergent species.
5. The forested wetland to the southeast (PFO1E), approximately 245 square feet in size, would only be flooded if the water rises to the 956 foot elevation. At the 950 foot elevation it may transition, some or totally, to a scrub-shrub wetland with a forested fringe, but at the 956 foot elevation it may drown and disappear due to the immediate topographic ridge it abuts, or it could become emergent marsh.
6. Forested wetlands could be created as the trees and shrubs could shift upslope depending on the micro-topography and the persistence of the water elevations, especially along the western forested "arms" that follow the unnamed and unidentified stream and runoff areas that run along the foot of the western slopes. However, the South Branch is narrowly held to the streambed to the south by topography and sandy soils. NWI does not show a riparian buffer along this section of the stream and it is unlikely that increased water elevation in the impoundment would push water far enough south to create wetlands there.

In summary, based on available maps and without benefit of a field investigation or survey, it appears that there could be a net loss of vegetated wetlands, particularly forested wetlands, associated with a 5-10 foot increase in impoundment elevations. The remaining wetlands would shift to emergent and aquatic bed types (PEM and PAB). The available information is insufficient to make an accurate calculation of wetland loss and gain by cover type. It also appears that no known rare, threatened or endangered species or exemplary natural communities would be affected by an increase in water levels.


Figure 4. Site 35 topographic map

## 1.3 SITE 35

Site 35 is located in the Town of New Ipswich at the village of Smithville east of the confluence of Fox Brook and Pratt Pond Brook, which join to become the West Souhegan River downstream of the dam (Figure 4, location and topographic map). The 20-acre impoundment behind the dam forks to the south, north and west, mainly following the stream beds of Pratt Pond Brook and Fox Brook to the west and northwest and Stark Brook to the north. These streams, although not wide, have relatively flat floodplains on either side that have developed to accommodate the increased spring flows from the surrounding hills. The southern lobe fills the level space at the foot of Page Hill. Page Hill rises to 1250 feet and limits the western edge of the impoundment, forcing water to follow the streambeds listed above. The elevation of the surrounding areas is fairly level on the north and west sides of the impoundment, although a small hill between Stark Brook and Fox Brook/Pratt Pond Brook causes the split between the two northern lobes.

Based on review of the surrounding elevation and topography, elevating the dam level would push water into the streambeds and floodplains of Stark, Fox and Pratt Pond Brooks. NWI maps (Figure 5) show a 4.5-acre emergent wetland system (PEM1E) that wraps along the edge of the impoundment from the west lobe to the north lobe. Although a vegetation survey was not performed in this assessment, typical deep emergent marsh vegetation observed elsewhere along the Souhegan River includes burreed, pickerelweed, arrowhead, and mild water pepper. On summer aerial photos, a band of vegetation extends from the emergent marsh into the impoundment – this is likely non-persistent, aquatic bed vegetation (PAB) such as pondweeds and spatterdock. These wetlands are often not shown on NWI maps, which are usually derived from photographs taken in spring or fall. We estimated the PAB wetland area to be approximately 3 acres. North of the emergent wetland on Stark Brook and west of the emergent wetland on Fox/Pratt Pond Brooks is approximately 5.5 acres of deciduous and coniferous forested wetlands (PFO1C and PFO4E). Deciduous forested wetlands are typically dominated by red maple, and the coniferous wetlands are often dominated by white pine and hemlock. The soils that lie along both of these streambeds and their floodplains (Naumberg fine sandy loam and Borohemists-ponded) are consistent with wetland vegetation (Figure 6, soils map), and extend well beyond the areas mapped as wetland by NWI. NWI maps may underestimate the area of forested wetland in this watershed.

Duration and timing of the water elevation changes will determine the nature of wetland impacts, and these are not precisely known. For estimating potential impacts, it was assumed that water levels would be higher than current levels by approximately 4 feet for most of the growing season. The 4 foot value is based on storage elevation information provided by the NH Dam Bureau (Mattaini, personal communication). Digital contour intervals in GRANIT and USGS maps are not small enough to precisely map the extent of standing water, and mapping scale issues between data sources did not allow for precise calculations of the existing wetlands areas and area of impact. We approximated the location of full pond on the 1963 topographic Plan of Storage Areas (USDA), which has four foot contour intervals (Figure 7, USDA Map). The following general predictions were made for the proposed action:

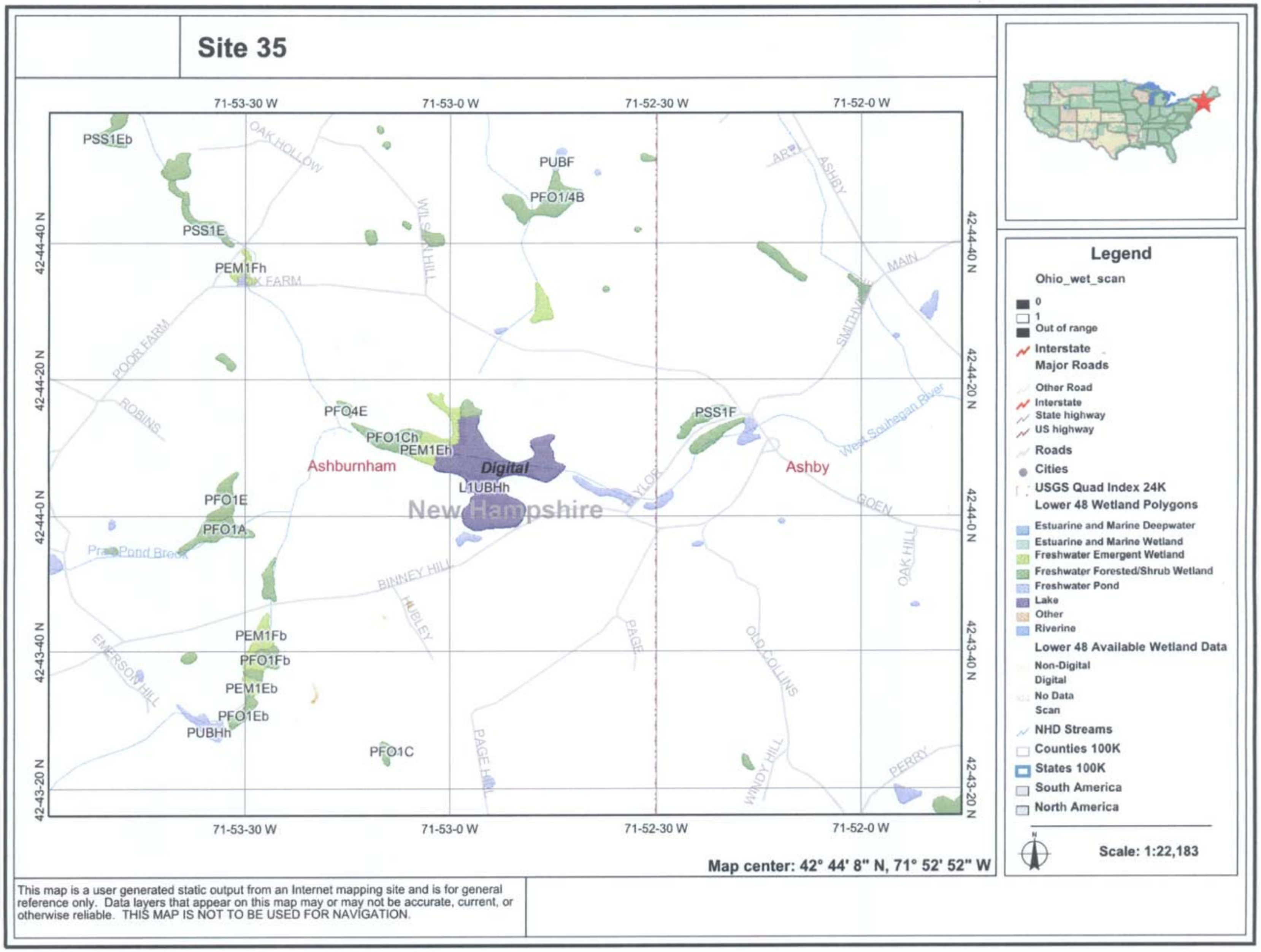


Figure 5. Site 35 NWI map

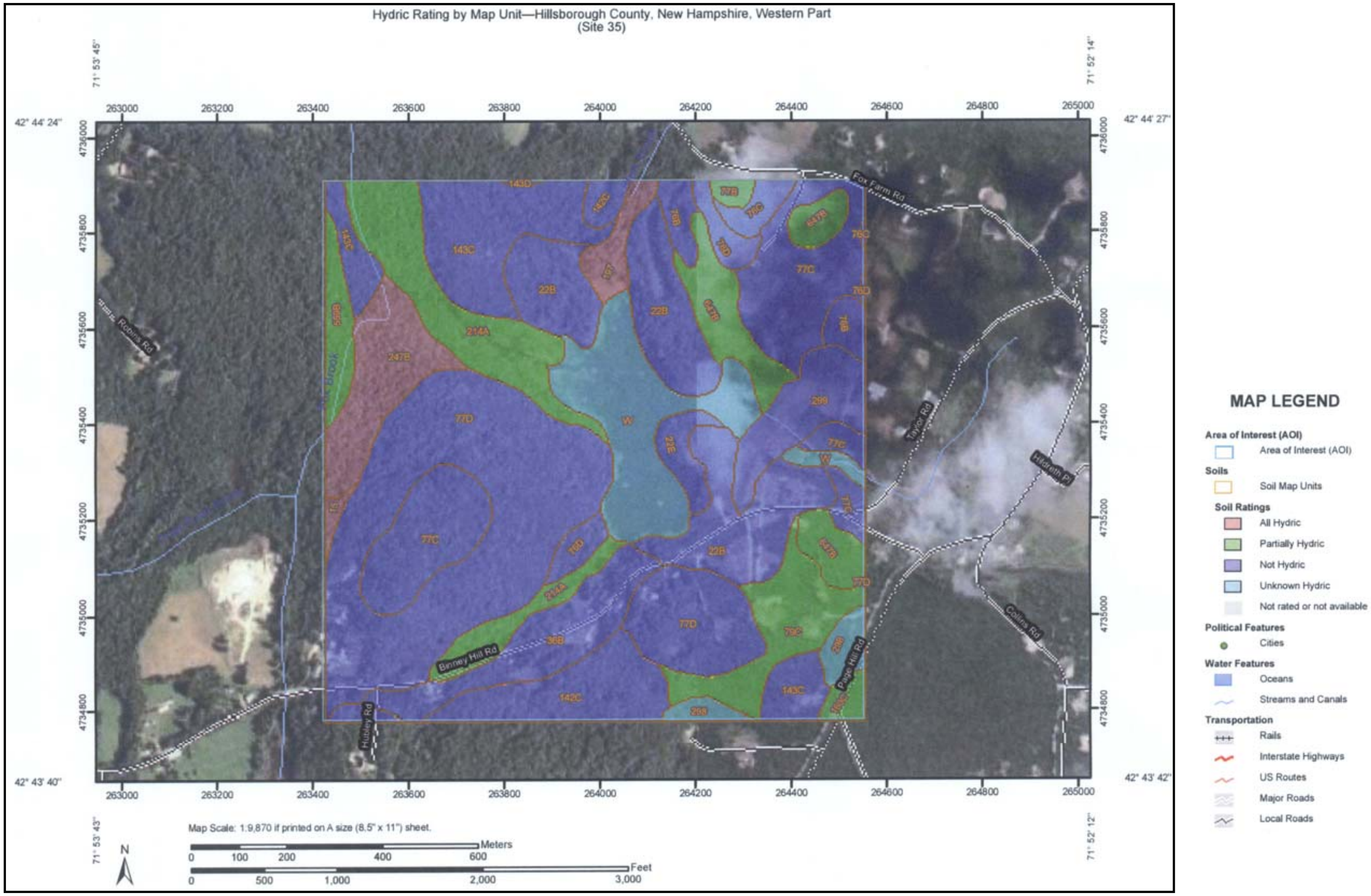


Figure 6. Site 35 NRCS soils map

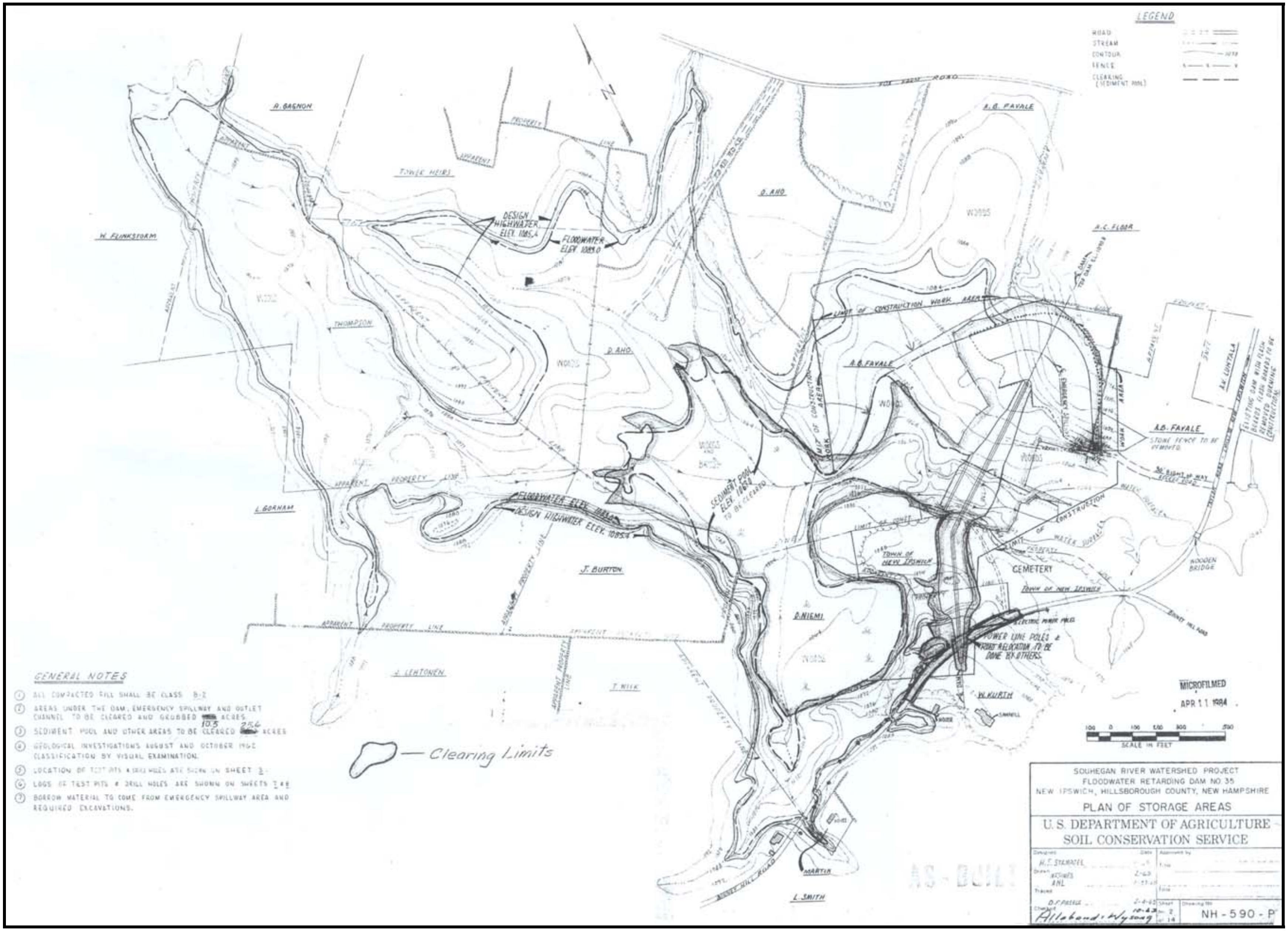


Figure 7. Site 35 As-Built Plan, dated October 1963

1. The existing deep marsh (PAB) would likely be replaced by open water or deep submergent vegetation.
2. Approximately 4.5 acres of existing emergent wetlands (PEM1Eh) bordering the impoundment will be converted to open water and submerged or floating-leaved aquatic plants (PAB) by a 4-foot increase in water levels, Over time, a new emergent marsh community may become established on stream floodplain terraces with summer water levels of approximately 1-6 inches, assuming some accumulation of organic matter. Based on a 1963 USDA topographic plan, this new emergent zone could be larger than the existing marsh. A zone of un-vegetated sand/gravel could develop just below the full pond elevation if water levels fluctuate frequently.
3. Trees within portions of the existing forested wetlands (PFO) that are inundated or saturated to the ground surface throughout the growing season would succumb within a few years, and emergent and scrub-shrub wetlands (PEM1, PSS1) would become established where water is at or near the surface during the growing season. As previously mentioned, the amount of emergent marsh may increase, and may extend beyond the NWI-mapped forested wetlands. Vegetation dominance would shift from facultative wetland trees and herbs to obligate wetland shrub and emergent species.
4. Forested and shrub-scrub wetlands may become established in uplands along the higher floodplain margins of the brooks, and in the upstream reaches of the impoundment fingers where somewhat poorly drained soils are present (including to the southwest and northeast of the impoundment where Naumburg soils are present but which appear to be forested uplands). This would likely occur slowly. Potential seed input from nearby wetland tree and shrub species is abundant, given the relatively undeveloped nature of the land in the surrounding area.

In summary, based on available maps and without benefit of a field investigation or survey, it appears that wetlands lost to flooding by a four-foot increase in impoundment elevations may be offset by the eventual development of additional wetlands along the tributary streams. The available information is insufficient to make an accurate calculation of wetland loss and gain by cover type. It also appears that no known rare, threatened or endangered species or exemplary natural communities would be affected by an increase in water levels.

## 2.0 LIMITATIONS OF EVALUATION

This evaluation was a "desktop" study and was conducted using the materials available online or provided by DES. No field assessment was conducted for this evaluation. In order to provide more precise approximations of the potential impacts of elevated water levels to the associated wetland communities, field studies should be conducted to confirm the existing wetland locations and community types (provided by the NWI and GRANIT maps). Updated survey or topographic data on a smaller scale than that which is available via online and existing maps, as well as additional data on the existing water levels, impoundment sizes and current operational regimes and detailed descriptions of the potential elevation changes and schedule would be needed to more precisely calculate the potential impacts.

## 3.0 REFERENCES

Mattaini, D. Personal communication (email) with Al Larson February 17, 2009.

# Appendix H

# Summary of Public Comments and DES Responses

## Souhegan River Water Management Plan

## August 2013

## SUMMARY OF PUBLIC COMMENTS AND DES RESPONSES

This appendix summarizes the comments received on the Draft Souhegan River Water Management Plan Report released by DES on June 23, 2011. The comments are summarized based on the issues of concern, and several of these areas are further subdivided into specific issues that received repeated comments. Each comment summary includes a response from DES. Copies of the comment letters and emails received by DES are included at the end of this Appendix.

Comments were received from the following individuals:

- Robin Babin - New Ipswich Resident
- John Klein - New Ipswich Resident
- Peter de Bruyn Kops - Amherst Farmer and WMPAAC member
- Cindy Lussier - Landowner at Souhegan River Site 19
- John and Sharon Rosenfelder - Landowners at Souhegan River Site 35
- Katrina Stark Soucy - Sweden, Maine Resident

### 1. Souhegan Designated River

***Comments and questions:***

- Towns manage their resources with growth and resources plans, which include water bans during dry spells. If the golf courses and the fish hatchery require additional water, then they should drill their own wells or dig water collection ponds to meet their needs.
- Proposed management is inadequate for the upper Souhegan River, the gage near Milford only allows for data collection where much of the water use has already taken place. DES needs to collect flow data at several points upstream to ensure that Affected Water Users are following their conservation plans, but also to protect upstream river environment that most likely will be negatively impacted by the increase in river flow due to two day releases.
- There is no management plan for silt build up, erosion damage, property damage, wetland destruction and public hazard.
- The statement that *"by artificially creating the effects of a small storm event, this release of water resets the instream flow system"* needs to be removed from the plan because it is false. There is no small storm that would create the flow of water anticipated in the release of 118 ac-ft from Site 35 and an additional 500 ac-ft from Site 19.
- The plan is confusing upstream effect with downstream effect. Upstream and downstream flows are two separate entities. While the downstream flow would reflect a small storm situation considering tributary swelling, a two day release from the two sites in the upstream area would cause a rush of water totally foreign to this vulnerable environment.
- The DES is not limiting the amount of water anticipated to flow. If the need increases downstream, more water will be stored and released.

- The Water Management Plan is based on protected instream flows that were developed and established as standards to provide 100 percent habitat preservation rather than considering how 50 percent of the habitat could be preserved.
- Because the Water Management Plan and Water Use Plans are based on the 100 percent habitat preservation standard, they are too extreme and unnecessarily costly.
- Habitat preservation was selective, and the proposal to release water from storage reservoirs upriver will impact habitat around ponds to benefit habitat downstream,
- Human activity has already impacted habitat yet the average layperson looking at the river, and the technical experts that studied the river, would consider the river to be healthy.
- Even with a healthy river at current levels of human activity, the proposed Water Management Plan and Water Use Plans aim to reduce water withdrawals at critical times.
- The implementation costs for water use metering and the development of alternative sources of water, growing different crops and risking crop failure are likely well over $1 million, taking into account all water users.
- The production of crops by farmers along the Souhegan River is increasing and with the growing demand for locally grown produce, crop production is expected to increase in the future. The Water Management Plan and the Water Use Plans will impact agricultural water users by increasing the cost of crop production which will result in less crop production and reduce job growth.
- A better and more cost-effective balance would be attained by defining adequate habitat at levels that allow for local agriculture, at a minimum, to withdraw significant water during dry spells.
- The implementation and enforcement of the Water Management Plan should be postponed until dams storing the relief flows are retrofitted and operational.

***DES Responses:***

The Water Management Plan includes the requirement that during periods when flow in the Souhegan Designated River drops below the Critical and Rare protected instream flow thresholds during the summer and early fall that Milford and Wilton impose water use restrictions or bans. The Plan also recommends that the Milford Fish Hatchery develop a supplemental water supply source. Direct withdrawals from the river by the agricultural water user and the golf courses would also be reduced. The Plan specifically recommends that the golf courses consider developing supplemental water supplies, which could include storage ponds or wells.

The United States Geological Survey (USGS) operates two gaging stations on the Souhegan Designated River. One gage, #01093852 is located in the upper portion of the watershed (103 sq. miles) in Milford, while the second gage, #011094000 is located in the lower portion of the watershed (171 sq. miles) in Merrimack. The gage in Milford was established in 2008 to record flows in the upper watershed in support of the instream flow program and is upstream of where the largest Affected Water Users are located. As proposed in the Water Management Plan, Affected Water Users (AWUs) in the upper watershed will take management actions in response to flows recorded at the Milford gage, while those AWUs located downstream of this gage will take management actions in response to flows recorded at the Merrimack gage.

The Water Management Plan does not specifically include a sub-plan to address the “silt build up, erosion damage, property damage, wetland destruction and public hazard” that will allegedly result from the proposed relief flow releases on the Souhegan Designated River. Relief flows have been distributed among four impoundments instead of the original two impoundments described in the Draft Water Management Report. None of the relief flows will be released at rates above historical flows so no damage or erosion is expected . The maximum relief flow rates below each impoundment include: 0.16 cfsm for Waterloom Pond; 0.41 cfsm for Site 19; 0.72 cfsm for Site 35: and, 2.47 cfsm for Site 12A. These values account for the size of the watershed at the release point below the dam. As a reference, flows of 0.5 cfsm have historically been used by the US Fish and Wildlife Service to define minimum summertime flows below hydropower facilities. Souhegan River flows, over the historic record, ranged from 0.23 cfsm to 84.0 cfsm. The most common flow is 2.47 cfsm which has occurred in the Souhegan River 20.6% of the recorded days. The impact of the relief flows on habitat in the Souhegan Designated River and the streams immediately downstream of the selected storage impoundments is not considered significant because the magnitude of the relief flows fall within the natural flow ranges for the receiving streams and river.

The Plan no longer includes releases of 118 ac-ft from Site 35 or of 500 ac-ft from Site 19. The plan is to release an equal volume of water from each of these two dams. The maximum flow release from Sites 19 and 35 would then be 18.4 ac-ft (4.6 cfs for two days) from each of them. The premise for the release of the relief flows is that when flows are below the Critical or Rare flow threshold for greater than their Catastrophic duration, a short-term increase in flow will mimic a natural small rainfall event, thereby temporarily increasing aquatic habitat for refuge from the low flow conditions.

The release flows are within the range of flows currently experienced by the smaller watersheds of the release origins. The commenter’s statement is true that the effect of the releases will be greater on the streams located immediately downstream from the flood control dams than on the Souhegan Designated River at the gage in Merrimack. The releases originate from dams on streams in smaller drainage areas which have lower flows than the Souhegan River. DES has assessed the release flow volumes on the small streams by estimating the flow ranges that naturally occur in these smaller drainages. The assessment has shown that the release flows are within the range of flows currently experienced by these streams. DES calculated the release flow rates relative to the drainage areas[1] and compared them to flow rates on the Souhegan relative to its drainage area. Stream flow was divided by the watershed area to derive a flow per unit area that can be compared at any location. The flow releases at all locations generally comprise flows that are similar to summer low flows except below Site 12A during one bioperiod. Release flows during October 1 through November 14 are of the same magnitude as flows that naturally occur about 10% of the time during that bioperiod.

[1] cfsm – cubic feet per second per square mile of watershed area

The commenter noted that "DES is not limiting the amount of water anticipated to flow. If the need increases downstream, more water will be stored and released." Water stored and released for protecting stream flows is not for downstream users, but rather will support the river ecosystem. Any new users will need to comply with the protected flows and create management plans that maintain the protected flows. The water storage described in the Water Management Plan provides for current and future conditions by providing sufficient storage to meet anticipated current management needs with additional storage as a safeguard. It is not the intent of the Water Management Plan to increase storage of water in any of the impoundments to offset increased future water use in the Souhegan River Water Management Planning Area. Rather, the intent is to support a more sustainable use of water by all water users in order to maintain instream flows to ensure the continued viability of the river ecosystem.

The statement that the Water Management Plan is based on protected instream flows that were developed as standards "to provide 100 percent preservation rather than considering how 50 percent of the habitat could be preserved," is incorrect. While the protected instream flows established for the Souhegan Designated River were developed as numeric translators of the narrative water quality standards, they are also based on the Natural Flow Paradigm. This concept takes into account the natural variability of flow, which occasionally fall below levels that support the protected entities. The protected instream flows are based on a statistical analysis of the streamflow record for the Souhegan River, which was then integrated with the results of the instream habitat mapping work to determine the protective flow thresholds and flow durations. The historical data and protected flow criteria define low flow thresholds that represent high-stress conditions for aquatic species. The Water Management Plan states that actions will be taken only when flows fall below the Critical or Rare thresholds for longer than the common duration. These conditions occur infrequently and represent those conditions when the protected instream entities are at the greatest risk due to limited habitat. Management is taken to offset these conditions. As a result, the Water Management Plan does not provide 100 percent habitat preservation at all times, but focuses on those periods during which catastrophic conditions can impose the greatest stress on the protected instream entities.

A commenter noted that because the Water Management Plan and Water Use Plans are based on the 100 percent habitat preservation standard, they are too extreme and unnecessarily costly. As noted above, the Water Management Plan and associated Water Use Plans are not based on 100 percent habitat preservation. The costs associated with the development and implementation of alternative water supply sources for use by some of the Affected Water Users actually reflects the cost to ensure that the natural flow patterns in the river are maintained to support its biological integrity in compliance with state water quality standards.

It was also suggested that habitat preservation in the Water Management Plan was selective, because the storage of water in the flood control dams upstream will impact the habitat around ponds to benefit habitat downstream. Since a reduction in the use of the river alone will not maintain the instream flows, the temporary storage of water at selected dams is necessary. The use of storage at these facilities for the purpose of creating relief flows has been limited to less than two feet of water level change in order to preserve habitat conditions in these environments. Most of these areas experience impacts greater than this since their impoundments are used for the storage and release of floodwater. DES recognizes that the benefits of the relief flows must offset the impacts of water storage for relief flows and, as such, will attempt to manage these facilities to minimize the negative impacts on the shoreline around the impoundments.

A commenter noted that human activity has already impacted habitat in the Souhegan Designated River and it seems healthy. DES agrees that the Souhegan River is largely healthy. The Water Management Plan applies management to current and future water use to ensure that this condition continues. The time to develop management plans to protect the river is before high levels of degradation occur and correction, therefore, becomes difficult. The impact of human activity on habitat in the Souhegan Designated River was noted in the Final Souhegan River Protected Instream Flow Report (DES 2008). DES notes that a number of problems exist, including water quality impairments for dissolved oxygen. Even a relatively healthy river, under current levels of human activity, will benefit from the Water Management Plan by reducing the pressure on important river functions at critical times. To minimize the further degradation of the river's health and to maintain its biological integrity, the Water Management Plan requires that actions be taken when the potential impact of withdrawals have the greatest impact on the river.

Although agricultural water users have withdrawn and will continue to withdraw water from the Souhegan Designated River, these amounts have been below reportable limits. DES supports the local production of crops and agrees that demand for these products will mostly likely continue to grow into the future, thereby increasing the demand for water. Registered water users are required under the existing Water Conservation Rules (Env-Wq 2102) to accurately record and report their water use to DES and to demonstrate the methods used to measure or quantify water use are accurate within 10 percent. DES can assist water users with the verification of their water use measurement method. If the accuracy of the method used cannot be verified within 10 percent, then the registered water use will be required to have an existing meter calibrated or, if an estimation method is used, the installation and operation of a recording meter may be required. The cost of the meter will depend on the size of pipe and volume of water used. The cost of the purchase and installation of a meter could be partially or completely offset through conservation grants available from the Natural Resources Conservation Service (NRCS) or depreciated as a business expense over time.

One commenter opined that development of supplemental (above the *de minimis* flow available under this program) alternative water supplies, such as storage ponds or wells, for agricultural irrigation represents a potential additional business cost resulting from the adoption of the Water Management Plan. This Plan provides guidance to these water users as to what actions may be taken when catastrophic conditions occur so they may plan according. The cost of the development of alternative water supplies along with the investment in more water efficient irrigation equipment could be partially or completely offset through conservation grants available from the NRCS or depreciated as a business expense over time.

It was suggested by one commenter that a better and more cost-effective balance would be attained by defining adequate habitat at levels that allow for local agriculture, at least, to withdraw significant water during dry periods. This approach could not be assured to comply with water quality standards. The protected instream flows established for the Souhegan Designated River were based on the results of an intensive field investigation and a detailed hydrologic analysis. The established protected instream flows are considered to provide adequate protection of the instream entities, and, along with the Water Management Plan, they promote sustainable water use. While it is recognized that agricultural demand along with golf course demand for irrigation will be greatest during "dry" periods, the *de minimis* flow will always be available to be shared among water users.

As noted in a comment, the Water Management Plan cannot be fully implemented until the outlet of the dams selected to store and release the relief flows are retrofitted. A source of funding for this purpose has not yet been identified and no money has yet been secured for this effort. DES has changed the plan to include more dams for flow management, one of which is already configured to allow for flow augmentation through relief pulses. The two year period following the adoption of the Water Management Plan will be considered a pilot period and the results of this pilot study will be reported to the legislature in 2015 for consideration in its review of the Souhegan River Water Management Plan.

Finally, the Protected Instream Flow for Bioperiod 6 (Salmon Spawning period which runs from October 1 – November 14) for the lower Souhegan River has been reduced. The original Protected Instream Flow established on April 1, 2008 was superseded by a new declaration of establishment on August 30, 2013. In the period following the establishment of the Protected Instream Flow for the Souhegan Designated River, DES became aware of an issue related to the protected flow in the Salmon Spawning Bioperiod (also known as Bioperiod 6, which runs from October 1 through November 14). Upon further review, DES has determined that the habitat quality would be the same at 0.1 cfsm as at 0.3 cfsm. Consequently, the protected instream flow for Bioperiod 6 for Rare flows has been changed from 70 cfs (0.4 cfsm) to 39 cfs (0.23 cfsm). The allowable and catastrophic durations remain the same.

## 2. Souhegan River Site 12A

***Comments and questions:***

- Using Site 12A South as the backup contingency site necessitates that it be ready in an emergency. This would call for permanent storage at this site at all times throughout the season. The plan lacks any information on the effect this would have on this site, whereas preliminary testing was done on Sites 19 and 35.
- There is no mention of the effect storage and release at this site would have on the role of this reservoir as the supplier for public water to the Town of Greenville.

***DES Response:***

Souhegan Site 12A South initially was identified as a contingency site to provide additional water if operation of Souhegan Sites 19 and 35 could not provide sufficient water to maintain the protected instream flows on the Souhegan Designated River. A detailed storage-discharge analysis was not performed for the Tobey Reservoir because the likelihood of its use was considered to be low. Based on the comments received on the Draft Souhegan River Water Management Plan Report, DES has changed the status of the Souhegan River Site 12A from a contingency site to a primary site. The change was necessary to reduce the impacts of storing additional water at Souhegan River Sites 19 and 35. DES plans to limit water levels changes at the dams selected for the storage and release of relief flows to two feet or less to limit the impacts to shoreline properties and the environment. The DES Dam Bureau concluded that the dam's structure would support the additional water storage of two feet defined as the limit for water level changes as a result of instream flow management. There was no need to define the maximum storage as was done for Site 19 and Site 35.

As noted in the Dam Management Plan for Souhegan River Site 12A South, an initial screening of the extent of mapped wetlands was performed and no significant wetlands were identified surrounding the impoundment. So the storage of additional water in this impoundment should not have a significant impact on wetlands.

As noted in the Water Management Plan and in the Dam Management Plan for Souhegan River Site 12A, 652 ac-ft (212 million gallons) of storage in the Tobey Reservoir is designated for the Greenville water supply. Based on historical records, the annual water use by the Town of Greenville has ranged from 41.4 to 67.4 million gallons (127 to 207 ac-ft) which leaves sufficient storage to address the Town's water supply needs. DES will not operate the Souhegan River Site 12A facility, for the release of relief flows, in a manner that would reduce the volume of water needed by the Town of Greenville water supply system. DES will notify the Town of Greenville in advance of any planned relief flow releases.

### 3. Souhegan River Sites 19 and 35

***Comments and questions:***

- Plan may benefit Milford, but abutters, neighbors and precious wildlife will lose.
- Plan will flood private land and impact shoreline recreation.
- Whereas the Plan includes in-depth analysis of river environment, it totally ignores the importance of wetlands. The wetlands have never been studied by a professional for endangered species.
- Because the proposal by DES is experimentation, damage to the wetland is unknown. Once lost, the wetlands cannot be replaced because drainage will continue year after year which will permanently destroy the environment. Replacing current wetland with new wetland is not a viable alternative in this situation and also means a loss in prime buildable waterfront land to the landowner.
- With reference to Site 35, and downstream, not only will current wetlands be destroyed but this portion of brook has houses right along the river's edge. Their foundation will

wear away from the repeated bursts of water flow. Also, the town roads are at water level and will be damaged by erosion.

- State has not been a good steward of the facility, poor maintenance of existing facility.
- How will new dam be maintained and who's going to check it on a regular basis?
- Why should abutters feel the State is actually going to oversee the project since the history of the dam's management is not a good one?
- Considering the financial condition of the State of New Hampshire how will this be funded?
- Public notification of the project has been limited and meetings were held in Milford who would benefit from plan.
- The landowners at the impoundment sites not only own the land under the water, but also pay taxes on the land under the water. Removing landowner's rights for representation clearly violates constitutional rights. Landowners need to be involved in decision making with equal say and equal voting capacity, not lowered to the level of petitioning.
- The public has a right to know what the state plans to do with privately owned land. Public hearings and formal re-adoption process will not be removed from the basic rights of citizens and landowners.
- The purpose of the site has been flood control and it serves this purpose, so let it be.

***DES Response:***
The purpose of the relief flows released from dams is to maintain the protected instream flows established for the Souhegan Designated River. The intent of the establishment of these instream flows is to sustain the protected entities along the designated river and not solely in Milford. In fact, during low flows in the summer through early fall periods when relief flows may occur, the Town of Milford and several other Affected Water Users along the designated river will be required to reduce their water use or water demand to help maintain the protected instream flows. As a result, they do not directly benefit from the relief flows, whereas the aquatic and riparian protected entities along the designated river will.

DES recognizes that the storage of water at the flood control dams for relief flows would have had an impact on shoreline property owners and shoreline habitat. As originally proposed, 118 ac-ft of water would have been stored at Souhegan River Site 35 to generate relief flows. Based on existing information, the storage of this volume of water would result in a 4 foot increase in water levels for most of the growing season. Although no Rare, Threatened or Endangered (RTE) or Exemplary Natural Communities were identified at the site, DES recognizes that a 4 foot change in water level would have an impact on surrounding shoreline habitat. Based on an initial assessment, most of the existing deep marsh at the site would be replaced by open water or deep submergent vegetation, approximately 4.5 acres of existing emergent wetlands would be converted to open water, and trees inundated within portions of the existing forested wetlands would succumb within a few years although new forested and shrub-scrub wetlands may become established along the floodplain margins of the brooks and the upstream reaches of the impoundment fingers. At Souhegan River Site 19 storage would have increased permanent water levels as much as 10 feet.

These impacts to wetlands and shorelines would have been likely if the full volume of water in the draft Water Management Plan was stored at these sites. In response to these concerns, DES has reduced the maximum increase in water level at the selected dams to two feet or less, which will require the use of more impoundments besides Sites 19 and 35. The water level change has been reduced by the use of additional impoundments at Souhegan River Site 12A (Tobey Reservoir) and Waterloom Pond. This action will reduce the impacts to the shoreline properties, wetlands and the use of these waterbodies for recreation.

For Souhegan River Sites 19 and 35, Normandeau Associates, Inc. (Normandeau) performed a screening level review of wetlands as well as Rare, Threatened or Endangered species and Exemplary Natural Communities using existing information. Normandeau wetland scientists reviewed the following information as part of this evaluation for both sites: National Wetland Inventory (NWI) maps via the Fish and Wildlife Service online mapping tool; aerial photos from TerraServer Imagery; soil maps from the Natural Resources Conservation Service (NRCS) Web Soil Survey; and New Hampshire GRANIT ArcGIS, which included aerial photos, topography and wetland layers, and maps and water elevation data provided by DES. Normandeau also conducted a search of the New Hampshire Natural Heritage Bureau (NHNHB) online database for information on Rare, Threatened or Endangered Species and Exemplary Natural Communities.

DES recognizes the concerns of a commenter regarding the impact of the elevated water levels at Souhegan River Sites 19 and 35 on wetlands and abutting private property. The wetland analysis performed by Normandeau assumed a water level change of 5 to 10 feet at Souhegan River Site 19, and a water level change of 4 feet at Souhegan River Site 35. These represented the water level changes needed to provide the maximum volume of storage of relief flow water at each facility. As noted in the Draft Souhegan River Water Management Plan Report, these water levels would have impacted existing wetlands, although some of these impacts would have been offset by the creation of new wetlands. To reduce the impacts to existing wetlands and to abutting landowners DES has reconsidered the original proposal and will limit any water level changes, for the storage and release of relief flow, to a maximum of two feet.

A commenter noted that there are houses located right along the edge of the brook downstream of Souhegan River Site 35 and that their foundations will wear away from the repeated bursts of water flow, and since the town roads are at water level they will be damaged by erosion. The magnitude of the relief flows, when divided among multiple sources, are more than an order of magnitude less than the estimated mean annual flood. Given this information, the potential for bank erosion and flooding of adjacent properties or roads is limited. Most instream road structures are designed to pass the 25-year flood event, which is significantly larger than the magnitude of the relief flow releases. There should be no impact to existing infrastructure from the release of the relief flows.

Recognizing the concerns regarding the past operation and maintenance of the flood control dams, DES will work closely with the DES Dam Bureau and surrounding property owners to ensure the proper operation and management of each state-owned dam to meet both the needs of the Protected Instream Flow Program and the shoreline property owners. DES will oversee the management of the project and be responsible for the proper operation of the dams for the storage and release of water for relief flows, as presented in the Dam Management Plans.

Future funding for the implementation of the Souhegan River Water Management Plan and its components has not been secured. Costs associated with the change in operation of Souhegan River Site 35 are significant and would include the retrofitting of the outlet structure (at an estimated minimum cost of $136,000), funding of staff for dam operation, and long term monitoring programs to document any environmental impacts at the site (see Appendix D). Similar costs are estimated for each of the state owned dams (Site 12A, Site 19 and Site 35).

DES has held several public meetings regarding the Souhegan River Water Management Plan over the past several years to discuss its approach. Several of these meetings were with the Souhegan River Water Management Planning Area Advisory Committee. DES has presented elements of the Water Management Plan at meetings with the Souhegan River Water Management Planning Area Committee on October 16, 2007 and April 8, 2011 in Milford. The Draft Souhegan River Water Management Plan Report was also presented at the Public Hearing held on July 26, 2011 in Milford. The Town of Milford was selected as the site for these meetings because it is located in the central portion of the Souhegan River watershed allowing easier access to residents from all parts of the study area, and because of the availability of a suitable facility to host these meetings. Subsequent to these meetings, DES met directly with residents and elected officials in New Ipswich and Greenville to discuss the Plan.

DES notified the public of each of these meetings through electronic emails or paper mailings to each of the Select Chairs of the Towns in the Souhegan Designated River watershed, and through posted notices on the DES web site. DES provided public notification of the release of the Draft Souhegan River Water Management Plan Report by these means and also through printed public notices in the Nashua Telegraph, DES sent mailings to notify all property owners at Souhegan River Sites 19 and 35 of the public hearing. Copies of the Draft Souhegan Water Management Plan Report were made available at the public libraries in Merrimack, Milford and Wilton for public review and were posted on the DES website a month before public hearing.

Media coverage of the development of the Souhegan River Water Management Plan has included several articles by David Brooks of the Nashua Telegraph ("Plans Pushed for River Management" on October 1, 2010, "Managing Rivers to be Topic of Public Meeting" on April 12, 2011 and "Souhegan River Plan to Surface" on July 25, 2011). Information presented at the Public Hearing was reported in an article by Kathy Cleveland in The Cabinet Press ("Plans Unveiled to Secure Viability of Souhegan River") on July 28, 2011. These articles were available in the printed and online versions of these publications.

DES contractors also discussed the elements of the Water Management Plan with the identified Affected Dam Owners and Affected Water Users. Representatives of the water departments or public works departments for the Towns of Greenville, Milford and Wilton reviewed and commented on their individual plans.

DES realizes that the change in the operation of the selected flood-control dams will have an impact on private property within the Sites 19 and 35 impoundments. As noted above, DES made significant effort to inform interested parties about the Souhegan River Water Management Plan and encouraged public involvement during its development. DES has received public comments about the Plan and acknowledges the concerns of the landowners abutting these facilities. The Plan mentions that under the Rules for the Protection of Instream Flow on Designated Rivers (Env-Wq 1900), persons may file a petition with the DES for changes to an adopted Plan. This option is available to persons affected by changes to the Plan. In response to the comments received on the Plan, DES expects to have additional discussions with the affected parties to resolve the outstanding issues associated with the storage and release of water from the selected flood-control dams prior to the implementation of those applicable portions of the plan. DES has changed the dam management plans significantly to reduce the overall effects of management.

DES recognizes the purpose and intent of the flood-control dams, and views the extension in their operation to also provide for the storage and release of water to maintain the protected instream flows for the Souhegan Designated River as an appropriate additional use of these facilities. DES has discussed these changes with NRCS and has received their support regarding this additional use of these facilities. DES will work with shoreline property owners to address their concerns and adapt the Dam Management Plans to minimize the impacts to them and their properties. DES also recognizes that, depending on the final dam configurations and water release regime at Sites 19 and 35, it is possible that existing flowage right agreements may have to be renegotiated.

**Changes to the Water Management Plan in Response to Comments**

In response to the comments received on the Draft Souhegan River Water Management Plan Report, DES has revised the number of flood control dams being considered for the storage and release of relief flows and has also capped the change in water level in their respective impoundments. Originally, only Souhegan River Sites 19 and 35 were being considered as primary sources of water for the relief flows and Souhegan River Site 12A was identified as a contingency site. This would have resulted in water level changes that of 4 to 10 feet in Sites 19 and 35 which would have unacceptably inundated adjacent properties and wetlands. The reduction in the volume of water to be stored at Sites 19 and 35 results from the addition of Souhegan River Site 12A and the Waterloom Pond Dam as storage sites for relief flow releases. The change in the use of Site 19, Site 35, Souhegan River Site 12A and Waterloom Pond is reflected in the revised Dam Management Strategy section of the Plan and in the individual Dam Management Plans.

# Appendix I

# Comment Letters on the Draft Souhegan Water Management Plan

## Souhegan River Water Management Plan

## August 2013

Robin Babin
10 Goen Road
New Ipswich, NH  03071
(603) 878-3020
m.muse10@comcast.net

August 18, 2011

C. Wayne Ives, P. G. Hydrogeologist
Instream Flow Specialist
Watershed Mangagement Bureau
NH  Department of Environmental Services
PO Box 95- 29 Hazen Drive
Concord, NH 03302-0095
Wayne.Ives@des.nh.gov

Dear Mr. Ives,

The Sohegan River Water Management Plan was recently brought to my attention by a concerned abutter of Dam Site 35 in New Ipwsich. I located a copy of 'TSRWMP' on the DES website. After looking at it and what it proposed, I have to admit I have concerns about this project as well.

I have lived in New Ipswich for 33 years and enjoy daily walks at this particular dam. It is a place of great natural beauty and is home to flora and fauna alike. This dam was built as a flood control dam, a function it has done well, protecting the folks who live downstream. It is obvious by the debris that collects against the drain, that the state/dam bureau woefully lacks proper funding for current upkeep and maintenance of this site as it is. The project as described, sounds like it will be costly, both in initial construction as well as to staff with skilled, authorized, full time, paid personnel.

As the dam has become home and habitat for so many forms of wildlife, raising and lowering the water level at will is going to have catastrophic effects. TSRWMP talks of saving "aquatic entities", "protection of water quality" and "aesthetic beauty". This, I presume, being for all of the people 'downstream' who will be getting what you are taking away from us. What about the "aquatic entities" at Dam 35 that will be impacted from fluctuating waters? What about protecting *our* water quality? What about the "aesthetic beauty" that will be left behind when Dam 35 has been reduced to swamp land by flooding then releasing its waters over and over?

What I find the most curious about TSRWMP is that it appears that it has been well publicized to those who will be sent this water. They have been privy to public hearings, educational forums and newspaper articles on TSRWMP. Why has *none* of this been brought to light to the citizens of New Ipswich? It has a clandestine feel to it.

If the state is so concerned about the fishes, let them spend their money more wisely by putting the cost of just one new 'gate' at Dam 35 towards a new well for the Fish Hatchery. The other users of the waters downstream could begin by studying, reviewing and implementing better conservation measures. We all must do so in periods of drought and not depend on robbing Peter to pay Paul.

Sincerely,
Robin Babin

## Ives, Wayne

**From:** JKLEIN_499@comcast.net

**Sent:** Tuesday, August 23, 2011 9:28 AM

**To:** Ives, Wayne

**Cc:** Burack, Thomas S

**Subject:** Souhegan Water Management Plan

Dear Mr. Ives,

I just very recently learned of the proposed plan for the Souhegan River Sites 19 and 35. Your Site Management Plan may benefit Milford, more specifically the golf courses and fish hatchery, but there would be a negative impact to the abutters to the sites and the wildlife that inhabit that area. Your plan would flood woodlands, recreational paths, well-established shoreline trees, underbrush, and wildflowers.

Other towns manage their resources with growth and resource plans which include watering bans during dry spells. If the golf courses and fish hatchery require additional water then they should drill their own wells or dig water collection ponds to meet their needs.

Also, I find it very interesting that no one who worked on the Souhegan Water Management Plan or from DES contacted our town selectmen to notified them of this plan. The town managers or selectmen of the towns impacted by this plan should have been informed early on and asked for their input. It appears that the intent was to inform as few people as possible of this proposed plan.

Who is going to oversee this project and monitor these dams on an ongoing basis to make sure they don't exceed the proposed water capacity, the state? The state is in a fiscal crisis now and should not allocate money for special projects like this one.

I really feel this plan should tabled until all of the towns affected have time to review it and the impact to those towns are assessed.

Sincerely,

John Klein, New Ipswich Resident

Souhegan Designated River Proposed Water Management Plan written comments
Tuesday, August 23, 2011

Comments by Peter de Bruyn Kops
mailing address: 379 Amherst St # 222, Nashua, NH 03063

My background and involvement
I own a farm along the Souhegan River in Amherst, with about 60 acres of tillable land that I have been told is among the best in NH. I grew squash and pumpkins commercially 10-15 years ago and pumped a small amount of water from the Souhegan during that time. I think I hit the reporting threshold for one month during my whole career so far. This land is presently in low value crops that do not need irrigation.

I have been on the Souhegan WMPAAC for the past 7 years.

My current business activities put me on all the major farms along the Souhegan River in Milford and Amherst on a regular basis and give me opportunity to chitchat with those farmers.

Regulations such as these tend to assume the world and people's behaviors remain pretty much the same. For agriculture in Milford and Amherst, this is not the case. We are in a long term trend of increased production of high-value vegetable crops. I know of four major farms along the river that are either in serious volume vegetable production now or are prepared to enter the business when other factors come into alignment. I expect these farms to grow both in terms of increased acres in cultivation and in a greater share of acres in higher-value crops.

New Hampshire produces only about 5% of the food it consumes. The other 95% depends on national fuel supplies and a relatively small number of key bridges. There is public policy at the Federal level to encourage more local food production and storage in New England. There presumably is a similar public policy goal in our State government.

Vegetable production is labor intensive. This means local food production provides jobs, roughly one job for every $40,000 in farm revenue. For the higher-value vegetable crops, this could mean one job for every 2 acres in production. There presumably is a public policy goal
to promote job creation for young people and the less skilled segments of the population.

The Water Management Plans (WMPs) and Water Use Plans (WUPs) add costs. Raising costs results in less being done. So raising costs of vegetable production will result in less vegetable production. The added costs include expensive meters ($5000+ present value for me) and development of alternate water sources for use when the WUP restricts withdrawals from the river. Even for high-value crops, vegetable production is a relatively low-margin business and so growth will be deterred by the prospect of large capital outlays such as for wells. (At the public hearing, it came out that a 40 gpm well will take several years and $250,000 to get approved and built.) The natural tendency will be to keep farm operation size under regulatory thresholds. There is no doubt that this WMP and WUP regime will slow the movement in Milford in Amherst towards higher-value vegetable and small fruit crops. If we compare two future worlds, one with this WMP/WUP and one without, it is clear the WMP/WUP will result in diminished value of agricultural production along the Milford and Amherst stretch of the river.

Supporters of these WMPs may argue that carefully-timed releases of water from upriver dams will reduce or eliminate times when low flow events curtail agricultural water withdrawals. Us farmers have no way of knowing if those rosy ambitions will turn out as hoped. We do know that setting up those dams will take money, and that money is in very short supply. It could be many years before those dams are operating. In the meantime, we have to plan on growing, or not growing, crops when we will not have access to significant river water when we need it most.

I recommend that implementation and enforcement of the WMPs be postponed until the proposed dams are in operation to reduce low flow events.

Souhegan Designated River Proposed Water Management Plan written comments
Wednesday, August 24, 2011

Comments by Peter de Bruyn Kops
mailing address: 379 Amherst St # 222, Nashua, NH 03063

At the end of the public hearing in Milford, Wayne Ives of DES pointed out that their standard was set by legislation to be habitat preservation and it would be nice if no other interests were harmed in the process. Wayne Ives elaborated that the standard for habitat preservation was 100% rather than consider how only 50% of the habitat could be preserved or how one could define preserving habitat to the 50% level.

It appears that the definition of “100% habitat” is based on the species mix that evolved, or would evolve, along the Souhegan River in the absence of human activities. Given the way life and evolution work, the species mix will expand and adapt to need all of the river water resources at critical, bottleneck, times. These critical times are generally low flow periods in dry spells when local agriculture needs water and would want to withdraw it from the river.

So it seems obvious to me that there is a logical contradiction between 100% habitat preservation and agricultural water use. If the 100% habitat preservation standard is followed to its logical end, one would have to conclude that there is no room for significant human activity in the watershed.

However, from the proposal to release water from storage reservoirs up river, we know that habitat preservation is a selective activity. Some habitats and species are sacrificed to preserve other habitats and species. Specifically, changing the way those dams are operated will cause habitat changes in and around those ponds.

Another way to look at this is to accept that human activities in the watershed are going to change the habitat, and then consider what species mix will populate the altered habitat. There is already a considerable level of human activity in the watershed which has changed the habitat. And yet your average layman looking at the river will consider it healthy. I believe that the technical experts who studied the river would also consider the river to be healthy.

Even with a healthy river at current levels of human activity, the proposed Water Management Plans (WMPs) and Water Use Plans (WUPs) aim to reduce water withdrawals at critical times. The implementation costs, including large wells, storage ponds, growing different crops, and risking crop failure during droughts, are significant, likely well over $1 million if we take into account all water users including golf courses.

The proposed WMPs and WUPs plans, because they are based on the 100% habitat preservation standard, are too extreme and unnecessarily costly. A better and more cost-effective balance would be attained by defining adequate habitat at levels that allow for local agriculture, at least, to withdraw significant water during dry spells.  The actual size of the Souhegan watershed is an historical accident, and therefore the species population mix that adapted to river flow rates from that watershed is also an historical accident.  To the extent that local agriculture withdraws water, the lower stretches of the river will appear in some ways as though the watershed is somewhat smaller.  The species population mix will adapt, the river will be healthy in a different way, and people who live around here will have the benefits of more local food production and related employment opportunities.

## Ives, Wayne

**From:** Cindy Lussier [pr1ncess21@comcast.net]
**Sent:** Tuesday, August 23, 2011 9:54 AM
**To:** Ives, Wayne
**Subject:** Souhegan WMP Comments

Cindy Lussier
110 Ashburnham Rd
New Ipswich, NH 03071
Pr1ncess21@comcast.net
878-3193

Wayne Ives
Souhegan WMP Comments
Watershed Management Bureau
NH Department of Environmental Services
PO Box 95 - 29 Hazen Dr
Concord, NH 03302-0095
Wayne.Ives@des.nh.gov

August 23, 2011

Dear Mr. Ives,

I am writing to echo every sentiment provided in both letters from the Rosenfelders. My family lives on dam site #19 on Ashburnham Rd in New Ipswich. We will be the main area affected by anything done to this dam site. Presently, at flood stage, we lose almost all of our property. So, what's next?!

It angers me the way we have been given such vague details and nothing has been said to the individual owners about the way each owner will be affected. As a child I remember my grandmother arguing on the phone about this dam being built. At that time the state tried to take this property by eminent domain. She fought back and "won". Instead of getting her property, they got the right to put the water on her land. She was left with barely any land for her house to be safe from flooding. So, is there still a cut off elevation or are you trying to take my property?

Like the Rosenfelders, we have worked our whole life for this land. Everything we have is tied up in this property. And now years later the same ugly threat is appearing. The state has adversely affected our lives and our pocketbooks since I bought this property from my grandmother's estate, also believing this to be a done deal, no further changes, after all, it was a court won case.

I have several examples. I will use one, to show how the state does not care for the dams as the Rosenfelders stated and I am so painfully aware of. We planted over 200 trees to start a Christmas tree farm. Shortly after we noticed the water seemed to flood up into the field where we planted and stayed there longer. I called water resources every year. After 3 years of this we noticed the trees growing up higher were doing fairly well, but the lower level trees never seemed to grow. We complained to water resources with no results. Finally someone learned the damn was blocked with debris, when they finally cleaned it out and the water didn't come up any more, it was too late. We had given all the trees away. Did anyone care how much time and energy went into that planting by a pregnant woman? Then to have to dig them up, because they didn't have a chance.

Then the state changed the laws about where we could put a septic system when I finally got to build my house where my grandmother's house had stood. We ended up having to put the septic under my front lawn, not where we wanted it. Just because some bureaucrats who don't know this property thought it would be underwater, they are wrong.

Because of the flooding, I've lost the ability to have two back lots here so my kids could each build here. Now after living here 29 years someone at Fema has redrawn the maps and I am forced to have flood insurance, at a great expense, on a property that can not flood, because of the spillway. So my question is, with this new map what is in store for us? The map shows the water going over my house and across the road, something that is impossible to do. Is this your plan? Are you going to try and take my property?! I have grown up here, my boys grew up here, no one should have to live in fear of losing their home like this. Thanks to state and federal government, we have been hurt financially and many other ways because of the people who have no idea about this property and what the real story is.

I still don't see any good reason to threaten someone else's whole lifestyle and possessions to hold back more water. For what purpose again? I think I missed that.

Another story about how much these people care, the state completely drained this pond, without notice to any of us. Emptied it completely, for some repairs? So where did the fish go? All the other life that some say they are concerned with? We could have gone in and done some cleaning and worked down there with some notice, made some improvements. Why weren't we told?!

In all the time we've lived here, NO ONE has ever spoken to us about the repercussions of this dam, NO ONE, except a fish and game officer, very nice man. But that's the world we live in. No one cares unless it affects them. So which is it? Are you trying to take my entire property from me or just submerge more of it?

I think it's time we start publicizing how you want to waste more hard earned money of the taxpayer while many of us are going without food and other necessities. We need answers! When do we get them?

Cindy Lussier

22 August, 2011

To:

Wayne Ives

New Hampshire Department of Environmental Services
PO Box 95
Concord, NH 03302-0095

From:

John Rosenfelder

86 Fox Farm Road

New Ipswich, NH 03071

jrosenfelder86@gmail.com

Dear Mr. Ives,

This weekend, I discussed with my wife Sharon, the possibility of upgrading our driveway.  Her opinion was that we should *not* invest any more money in our home because of the DES plan to flood our property, thus rendering it worthless.  The main attraction of our property is that abuts and underlies dam site #35 and a substantial part of its pond.  Our land is very flat and only slightly above the mean water level of the pond.

Apparently the DES has plans to end the long agreed upon *use* of dam site #35, changing it from *flood control* to *providing water for sport fishing and golf course irrigation* in the town of Milford.  Water would be held back in large volumes in New Ipswich, thus inundating our land and that of our neighbors, and then releasing it as required to benefit Milford.

Presently the water is simply held back during snow melt, and released over a period of a few weeks in the spring.  Most of the year, the pond is at a consistent level plus or minus a foot or so.

There have been many times when the state neglected to manage the dam at all, either letting the outlet get plugged with debris, or leaving the water level very high or very low for many weeks at a time.

At the WPA planted red pine grove near the shore on our property, recent excessively high water levels have floated a twelve inch deep layer of decomposing pine needles off the land, leaving mostly gravel behind.  This organic material, built up for sixty years material is now gone, presumably deposited downstream somewhere..

When we bought our property in 1980, it was with the knowledge that certain flowage rights had previously been deeded to the state for the purpose of *flood control*.  Since we were aware of the once-a-year cyclical nature of the water level, this was an acceptable easement.

We have scrimped and saved for over thirty years to buy our land and build a modest house.  We have been good stewards of the land, improving timber, removing dead trees, cleaning branches out of small in-feeding brooks, lopping knots from potentially commercially valuable pine trees, encouraging the best trees, building trails, cleaning up dead falls, removing weeds, tires, discarded furniture, stumps and broken glass from the water.  We do not restrict access to fishermen, walkers, swimmers, or equestrians, and have allowed hunters, who have used the land since long before we owned it to hunt responsibly.

The state does not have a good record of managing dam site #35.  When a huge clear-cut was made on Locke Road in New Ipswich, which made one brook feeding the pond run chocolate-brown with silt for eighteen months, reducing its depth and accumulating 6-12" of silt on the bottom, the state did nothing.

The state doesn't seem to be able to manage landslide risks along the Souhegan in Greenville or Wilton. An earthen dam holding back tons of water, poorly managed during deluges, similar to what we have had in recent years would be at risk of catastrophic failure.

If dam site #35 is used as a toilet tank for the benefit of the residents of Milford, raised water levels will kill thousands of trees and destroy a large wildlife habitat. As the water level drops to irrigate Milford golf courses, stinking mud flats covered in dead fish, dead reptiles and dead aquatic plants will be exposed, and the sterile higher ground, freed of its organic matter will be subject to erosion. Forestland trees are not tolerant of standing in deep water for extended periods of time. During periods of neglected management we have already seen this happen. We can smell the decay from hundreds of yards away.

A pond with water levels that fluctuates wildly will not be hospitable to the resident pond fish and water creatures, as water temperatures will swing just as wildly. Now there is a healthy population of bass, pickerel, hornpout, perch, sunfish, frogs and turtles.

The beauty of the site will be destroyed when the water level fluctuates from acres of flooded woods when high, to low levels exposing black muck and stumps left from the original dam construction. In spite of the attractive mountain views, fishermen will not want to cast their lines from amongst a flooded forest, or to wade waist deep through muck to get to the water.

We are told that there are no protected or endangered species anywhere in the vicinity of dam site #35, but no study was conducted. Just because no one looked, does not mean these plants and animals do not exist. We know that some wild flowers, plants, and fauna only appear for a few weeks or days at certain times of the year.

Hearings to disseminate information about this property flooding project were not well publicized, and were held *not* in New Ipswich, which would be dramatically affected, but in Milford the town that would reap the benefits of the project. If a neighbor wants to make a subdivision, or change the use of their land, we receive a registered letter, and read published notices, with an invitation to voice our concerns, if any. In the case of changing the long ago agreed upon use of dam site #35, great effort was made to avoid informing the abutters. We find that most of our neighbors knew nothing about the DES plans. Certainly no one from the DES has extended the courtesy of meeting with my family and explaining how ruining our beloved land will benefit us.

1. The State of New Hampshire does not have a great financial surplus to spend to benefit some towns at the detriment of others.
2. The existing dam has created a pond that has existed since 1965, and served its purpose well. It has become part of the landscape of New Ipswich. Its beauty and character will be lost forever.
3. This would be a significant change in the flood control easement agreement with land owners, which we would not agree to.
4. So far the publicity of this project has been done in a secretive way to keep impacted land owners in the dark. It has not been done on the up-and-up. Opportunities to voice concerns have been curtailed and limited, to favor the DES point of view, not the land owners.
5. No studies of the effect on our property and the environment have been conducted.
6. The state's past history of managing this dam site is poor at best.
7. The setting of our home will be ruined and rendered un-livable for us. We did not sacrifice for decades to buy this property, and invest much of our lives, to see it become a wasteland of flooded trees, or rotting mud flats.

Sincerely,

John Rosenfelder

Sharon Rosenfelder
86 Fox Farm Road
New Ipswich, NH 03071
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(603)878-3487

July 27, 2011

C. Wayne Ives, P. G. Hydrogeologist
Instream Flow Specialist
Watershed Mangagement Bureau
NH Department of Environmental Services
PO Box 95- 29 Hazen Drive
Concord, NH 03302-0095
Wayne.Ives@des.nh.gov

Dear Mr. Ives,

My husband, John, and I are 30-year abutters to Souhegan River Site 35. Your Site Management Plan may benefit Milford, but abutters, neighbors, and precious wildlife, will lose. Your plan would flood woodlands, recreational paths, well-established shoreline trees, underbrush, and sundews and other wildflowers. Additionally,the pond's animal life would lose essential habitat.

When John and I bought our property lot 30 years ago, we purchased it because of its features and location. We have a shore front, a stand of red pines planted by WPA years ago, beautiful woods, wetlands, stonewalls, and abundant wildlife in the woods. The property crosses Souhegan Site 35.

During the past 30 years, John and I have established a gravel beach for our family along the shore line . A stand of red pine towers near the water's edge where we have held campouts for numerous years with friends, family, and church members. Our neighbor uses the shore to train his Labrador retrievers for hunting.

My personal refuge is walking to the pond to watch wildlife. John spent many hours clearing trails in the woods so the walk would be an easy one. Your plan would flood our woods and paths. Your plan would reduce wildlife habitat. Your plan would steal what my neighbors and I treasure, our well-established property that we have worked hard to protect.

The flood control dam atSouhegan Site 35 has a history. In the past, I have had to call the site's supervisor to have the site maintained. The output has been clogged resulting in flooded woods for weeks at a time. The State has not been a good steward of its project. Several years ago, upstream from the dam, a neighbor cleared acres of land resulting in arelease of silt into the pond. A local hunter reported the water's condition because he fishes and was concerned about the fish. The State was not aware nor did it take action against the neighbor who silted the water. Other times the pond has been drained to an all-time low for critical periods of time. The water has become so shallow I don't know how or if the fish have survived.

Should you get the okay to follow through on your management plan, how is the new dam going to be maintained? There is a plan for reworking the dam, but who is going to actually check the output on a regular basis? With less money being spent on the State level, why should the abutters feel the State is actually going to oversee the project? The history of the dam's management is not a good one. For a state that'slaying off teachers and firefighters, why is money being allocated for this project?

**The purpose of Souhegan Site 35 has been flood control**. **The dam serves its purpose.Let it be**.

Sincerely,

Sharon Rosenfelder, Abutter to Site 35

FROM THE DESK OF
KATRINA STARK SOUCY

August 25, 2011
C. Wayne Ives
Hydrogeologist
Watershed Management Bureau:DES
29 Hazen Dr.
Concord, NH 03302

Dear Sir or Madam:

It is fortunate that the *Souhegan River Water Management Plan Report* proposed by NH Department of Environmental Services is termed a draft because it is in need of major revision. The plan fails to provide vital information in areas and requires further study on several important issues. In the state's desperate attempt to preserve the Souhegan River and clean up Milford's chemical waste dumps that have rendered the aquifer useless, the state has willingly sacrificed upstream privately-owned wetlands and forests. By the state's own admission, it is a pilot program so experimental in its concept that it lacks adequate perimeters to provide upstream landowners with solid information to make informed decisions during negotiations. In fact the

172 BLACK MOUNTAIN RD. SWEDEN, ME 04040

plan weighs so heavily in favor of the state and the water users that it ignores basic landowners rights, leaving the State of NH vulnerable to lengthy and costly lawsuits.

Major flaws in the plan are listed below starting with a quote from the actual plan and followed by comment. (Page number corresponds to the page on the CD.)

*Protected instream flows were developed separately for the two portions of the Souhegan Designated River due to the differences in the river's characteristics upstream and downstream of North River Road Bridge and just east of the Wilton and Milford line.* (p. 10)

*The relief flow pulses carried out under Dam Management Plans in the Water Management Plan will be coordinated by DES and managed by DES as the owner of the pertinent dams. The Conservation Plans and Water Use Plans will be conducted by AWUs in response to stream flow conditions. Those flow conditions will be from the USGS gage 01093852 near Milford for the upper Souhegan Designated River and USGS gage 01094000 at Merrimack for the lower Souhegan Designated River.* (p.12)

The proposed management is inadequate for the Upper Souhegan Designated River. The gage near Milford only allows for data collection at a point where much use of the water has already taken place. DES needs to collect data points at several points upstream, not only to ensure that AWUs are following their conservation plans, but also to protect upstream river environment that most likely will be negatively impacted by the increase in river flow due to the two day release. There is no management plan relevant to silt build-up, erosion damage, property damage, wet-land destruction, and public hazard.

*By artificially creating the effects of a small storm event, this release of water resets the instream flow system.* (p.49)

*If the catastrophic events is found to increase, the long term watershed-scale management actions may be required to off-set or reduce the frequency of these events.* (p. 49)

The first line needs to be removed from the plan because it is false. There is no small storm that would create the flow of water anticipated in the release of 118 ac-ft from Site 35 and an additional 500 ac-ft from Site 19. The plan is confusing upstream effect with the downstream effect. As the DES noted before, upstream and downstream flows are two separate entities. While the downstream flow would reflect a small storm situation considering tributary swelling, a two day release from two sites in the upstream area would cause a rush of water totally foreign to this vulnerable environment.

In addition, DES is not limiting the amount of water anticipated to flow. If the need increases downstream, more water will be stored and released. This is so experimental, that it ignores the irreparable damage to property, environment, and landowner's rights. It totally leaves DES in charge of property that does not belong to the state.

*DES would decide to fill the two impoundments following spring runoff. Management events from late spring through early fall bioperiods (from May first to Sept. thirtieth Clupeid Spawning, GRAF Spawning, and rearing and growth bioperiods) will be supported by shared releases from Souhegan River Site 19 and Site 35, and in an emergency, from Souhegan River Site 12A South.* (p. 50)

Using Site 12A South as the backup contingency site necessitates that Site 12A be ready in an emergency. This would call for permanent storage at this sight at all times throughout the season. The plan lacks any information on the effect this would have on this site, whereas preliminary testing was done on Sites 19 and 35. Also, there is no mention of the effect storage and release at this site would have on the role of this reservoir as the supplier for public water to the Town of Greenville.

*The proposed management actions will be coordinated by DES in cooperation with the Affected Water Users and the Affected Dam Owners.* (p.81)

*Adaptive management and other changes to the Water Management Plan may be made after its adoption if need for a correction is based on discussions between DES and Affected Water Users or Affected Dam Owners.* (p.81)

*There is a process for petitioning for a change to the Water Management Plan under Env-Wq 1906.08, Petition for Changes to an Adopted Water Management Plan. This process for revising the Water Management Plan through a petition to DES was made comprehensive in order to provide sufficient information to make a determination and to avoid frivolous change requests. This comprehensive process in the rules has lead to concern that, once adopted, modifying the Water Management Plan for minor changes would be an overly burdensome and perhaps prohibitive process.* (p.82)

*If a waiver was approved, the Water Management Plan would be updated by a revision without the requirement of a public hearing and formal re-adoption process.* (p. 82)

Ours is not a totalitarian government. Ours is a democratic government. It needs to be noted here that the landowners at the impoundment sites not only own the land under the water, but they also pay taxes on the land under the water. Removing landowner's rights for representation clearly violates constitutional rights. Landowners need to be involved in decision making with equal say and equal voting capacity, not lowered to the level of petitioning. The word frivolous needs to be removed from the document. It is offensive. In addition, the public has a right to know what the state plans to do with privately owned land. Public hearings and formal re-adoption process will not be removed from the basic rights of citizens and landowners.

*Based on a review of information available from the New Hampshire Natural Heritage Bureau, (NHNHB), there do not appear to be any federal or state-listed Rare, Threatened, or Endangered (RTE) species or any Ex-*

*emplary Natural Communities in the vicinity of the site. As a result, they would not be affected by an increase of water levels at the site.* (p. 240)

*Since the duration and timing of the increased water elevations aren't known, the extent of the impact to the existing wetlands is also unknown. But it is believed that if the water levels were raised by 5-10 feet through the growing season repeatedly, there could be a net loss of vegetated wetlands.* (p. 241)

*The storage of water at the Site 35 Dam above its permanent pool level may not result in a significant loss of wetland at the site. A preliminary analysis of the impact of the higher water elevations (4 feet) showed that the loss of existing emergent wetlands might be offset by increases in forested and shrub-scrub wetland around the impoundment along with the development of additional wetlands along the tributary streams (Fox Brook and Stark Brook).* (p.250)

Whereas the plan includes in-depth analysis of river environment, it totally ignores the importance of wetlands. Investigations are inconclusive to the point that the preliminary tests lacked a summary and only included data collection without comprehensive interpretation to make the study reader-friendly. The wetlands have never been studied by a professional for endangered species. Also, because the proposal by DES is experimental, damage to the wetland is unknown. Once lost, the wetlands cannot be replaced because drainage will continue year after year which will permanently destroy the environment. Replacing current wetland with new wetland is not a viable alternative in this situation and also means a loss in prime buildable waterfront land to the landowner.

*The upper portion of the river corridor downstream of the dam to Smithville is lightly developed and there are three small impoundments within this section of the West Branch. In this section, the West Branch passes below both Taylor Road and Page Hill Road. During a flow management release from the dam, some of the flow may be temporarily stored in the impoundments, but due to their small size this impact should be relatively small.* (p.250)

Not only will current wetlands be destroyed, but this portion of the brook has houses right along the river's edge. Their foundations will wear away from the repeated bursts of water flow. Also, the town roads are at water level and will be damaged by erosion. Persons downstream from the dam are not to be notified of release times according to the plan causing a huge public hazard.

This summary is but a small look at the problems and inadequateness of the proposed plan by DES. The plan ignores landowners' rights and ignores upstream importance. Once damaged, this pristine, upstream, water-side, buildable property cannot be replaced. Many of these tracts of land have been in families for generations and are therefore priceless. Removing property owners rights is intolerable. It goes without saying that DES needs to investigate alternate plans such as purchasing land along the Wilton/Milford corridor now owned by the Norris Company and the Fini Company. Also, DES needs to investigate the use of water towers or home use of cisterns in the Milford region.

It is offensive that the Schedule for Dam Management Plan Implementation is simply:

*This Dam Management Plan will be put into practice after adoption of the Souhegan River Water Management Plan and after the completion of the outlet structure.* (p.241)

There is no reference to the need to negotiate with landowners.

Sincerely yours,

Katrina Stark Soucy