

# Souhegan River Instream Flow Implementation Study



**Souhegan WMPAAC**

**July 20, 2015**

# Evaluation of the Instream Flow Program at NHDES

| <b>Activity</b>  | <b>Timeframe</b>                  |
|--|-----------------------------------|
| <b>Adopted the Water Management Plans</b>                            | August 30, 2013                   |
| <b>Two-year implementation period</b>                                | September 1, 2013 – 2015          |
| <b>Informational meetings in the Souhegan and Lamprey watersheds</b> | July 20 and July 29               |
| <b>Draft report released</b>   | September 1, 2015                 |
| <b>Public hearings in Souhegan and Lamprey Watersheds</b>            | Mid – September                   |
| <b>Public comment period</b>   | Mid-September through mid-October |
| <b>Final Report Due</b>  | December 1, 2015                  |

# Studies and discussions for the implementation period

- How can we tell if ISF management is having positive or negative ecological effects?
  - What studies are needed for long-term monitoring of ecological conditions?
  - What are the key indicators?
  - What are the criteria for applying adaptive management?
  - How can public input be improved?
  - What processes are needed for notification?
- (continued)

## Studies and discussions for the implementation period (continued)

- When and how should enforcement be applied?
- Can the process be streamlined? Can it be described briefly?
- What effects do dam removals have?
- What costs are there for studies, NHDES staff, dam modifications?
- What are the costs to business?
- What effects does management have on temperature and conductivity?

# Report outline

- I. Introduction
  - II. Lessons Learned
  - III. Impacts
  - IV. Plan for other rivers
  - V. Proposed legislation
  - VI. Development of new ISF Rules
  - VII. Public comments
  - VIII. Conclusions
  - IX. Recommendations
- (with details in several appendices)

# I. Introduction

- Describes:
  - overview and organization of the report
  - review of the ISF study and WMP

# Souhegan Protected Flows

**Table 1 - Instream Protected Flows for the Segments of the Souhegan River Designated as Protected Pursuant to RSA 483:15, XIII**

| Upper Souhegan Protected Instream Flows for Fish |   |                  | Common flow       |                    |                           |                              | Critical flow       |                      |                           |                              | Rare Flow       |                  |                           |                              |
|--|---|------------------|-------------------|--------------------|---------------------------|------------------------------|---------------------|----------------------|---------------------------|------------------------------|-----------------|------------------|---------------------------|------------------------------|
| Time of Year                                     | Controlling IPUOCR Upper Souhegan Flows | Bioperiod        | Common flow (cfs) | Common flow (cfsm) | Allowable duration (days) | Catastrophic duration (days) | Critical flow (cfs) | Critical flow (cfsm) | Allowable duration (days) | Catastrophic duration (days) | Rare flow (cfs) | Rare flow (cfsm) | Allowable duration (days) | Catastrophic duration (days) |
| Jan 1 – Feb 28                                   | Fish overwinter                         | Over-Wintering   | 204               | 2.0                | 35                        | 50                           | 51                  | 0.50                 | 15                        | 30                           | 31              | 0.30             | 5                         | 10                           |
| Mar 1 – Apr 30                                   | Spring flood                            | Spring Flood     | 389               | 3.8                | 28                        | 36                           | 113                 | 1.1                  | 12                        | 16                           | 82              | 0.80             | 5                         | 7                            |
| May 1 – Jun 14                                   | Shad spawning                           | Shad Spawning    | 215               | 2.1                | 25                        | 40                           | 61                  | 0.60                 | 10                        | 15                           | 38              | 0.37             | 4                         | 7                            |
| Jun 15 – Jun 30                                  | GRAF spawning                           | GRAF Spawning    | 24                | 0.23               | 20                        | 27                           | 11                  | 0.11                 | 10                        | 20                           | 8               | 0.08             | 10                        | 15                           |
| Jul 1 – Jul 14                                   | GRAF spawning                           |                  | 31                | 0.30               | 30                        | 42                           | 16                  | 0.16                 | 15                        | 35                           | 10              | 0.10             | 5                         | 30                           |
| Jul 15 – Aug 21                                  | GRAF rearing & growth                   |                  | 31                | 0.30               | 30                        | 42                           | 16                  | 0.16                 | 15                        | 35                           | 10              | 0.10             | 5                         | 30                           |
| Aug 22 – Sep 14                                  | GRAF rearing & growth                   | Rearing & Growth | 31                | 0.30               | 30                        | 42                           | 16                  | 0.16                 | 15                        | 35                           | 10              | 0.10             | 5                         | 30                           |
| Sep 15 – Sep 30                                  | GRAF rearing & growth                   |                  | 31                | 0.30               | 30                        | 42                           | 16                  | 0.16                 | 15                        | 35                           | 10              | 0.10             | 5                         | 30                           |
| Oct 1 – Nov 14                                   | Salmon spawning                         | Salmon Spawning  | 41                | 0.40               | 30                        | 40                           | 10                  | 0.10                 | 12                        | 23                           | 10              | 0.10             | 10                        | 23                           |
| Nov 15 – Dec 1                                   | Fish overwinter                         | Over-Wintering   | 204               | 2.0                | 35                        | 50                           | 51                  | 0.50                 | 15                        | 30                           | 31              | 0.30             | 5                         | 10                           |
| Dec 2 – Dec 31                                   | Fish overwinter                         |                  | 204               | 2.0                | 35                        | 50                           | 51                  | 0.50                 | 15                        | 30                           | 31              | 0.30             | 5                         | 10                           |

| Lower Souhegan Protected Instream Flows for Fish |   |                  | Common flow       |                    |                           |                              | Critical flow       |                      |                           |                              | Rare Flow       |                   |                           |                              |
|--|---|------------------|-------------------|--------------------|---------------------------|------------------------------|---------------------|----------------------|---------------------------|------------------------------|-----------------|-------------------|---------------------------|------------------------------|
| Time of Year                                     | Controlling IPUOCR Lower Souhegan Flows | Bioperiod        | Common flow (cfs) | Common flow (cfsm) | Allowable duration (days) | Catastrophic duration (days) | Critical flow (cfs) | Critical flow (cfsm) | Allowable duration (days) | Catastrophic duration (days) | Rare flow (cfs) | Rare flow (cfsm)  | Allowable duration (days) | Catastrophic duration (days) |
| Jan 1 – Feb 28                                   | Wood Turtle hibernation                 | Over-Wintering   | 342               | 2.0                | 35                        | 50                           | 86                  | 0.50                 | 15                        | 30                           | 51              | 0.30              | 5                         | 10                           |
| Mar 1 – Apr 30                                   | Spring flood                            | Spring Flood     | 650               | 3.8                | 28                        | 36                           | 188                 | 1.1                  | 12                        | 16                           | 137             | 0.80              | 5                         | 7                            |
| May 1 – Jun 14                                   | Shad spawning                           | Shad Spawning    | 178               | 1.0                | 15                        | 25                           | 96                  | 0.60                 | 5                         | 10                           | 88              | 0.50              | 5                         | 10                           |
| Jun 15 – Jun 30                                  | Oxbow and backwater marsh maintenance   | GRAF Spawning    | 39                | 0.23               | 17                        | 25                           | <b>239 / 26</b>     | <b>1.4 / 0.15</b>    | <b>13 / 15</b>            | <b>23 / 20</b>               | <b>325 / 17</b> | <b>1.9 / 0.10</b> | <b>10 / 10</b>            | <b>10 / 10</b>               |
| Jul 1 – Jul 14                                   | Oxbow and backwater marsh maintenance   |                  | 39                | 0.23               | 17                        | 25                           | <b>239 / 26</b>     | <b>1.4 / 0.15</b>    | <b>13 / 15</b>            | <b>23 / 20</b>               | <b>325 / 17</b> | <b>1.9 / 0.10</b> | <b>10 / 10</b>            | <b>10 / 10</b>               |
| Jul 15 – Aug 21                                  | Oxbow and backwater marsh maintenance   | Rearing & Growth | 103               | 0.60               | 20                        | 40                           | 26                  | 0.15                 | 15                        | 20                           | 17              | 0.10              | 5                         | 10                           |
| Aug 22 – Sep 14                                  | Oxbow and backwater marsh maintenance   |                  | 103               | 0.60               | 20                        | 40                           | 26                  | 0.15                 | 15                        | 20                           | 17              | 0.10              | 5                         | 10                           |
| Sep 15 – Sep 30                                  | GRAF rearing & growth                   | 103              | 0.60              | 20                 | 40                        | 26                           | 0.15                | 15                   | 20                        | 17                           | 0.10            | 5                 | 10                        |                              |
| Oct 1 – Nov 14                                   | Salmon spawning                         | Salmon Spawning  | 184               | 1.1                | 23                        | 40                           | 96                  | 0.60                 | 12                        | 40                           | 39              | 0.23              | 5                         | 10                           |
| Nov 15 – Dec 1                                   | Fish overwinter                         | Over-Wintering   | 342               | 2.0                | 35                        | 50                           | 86                  | 0.50                 | 15                        | 30                           | 51              | 0.30              | 5                         | 10                           |
| Dec 2 – Dec 31                                   | Wood Turtle hibernation                 |                  | 342               | 2.0                | 35                        | 50                           | 86                  | 0.50                 | 15                        | 30                           | 51              | 0.30              | 5                         | 10                           |

**Bold values are upper limits for instream flow for protection of GRAF spawning. Flows should not be created that exceed these magnitudes and durations.**

## Souhegan Protected Instream Flows for Natural Communities, Wildlife Habitats and Rare, Threatened or Endangered Wildlife and Plants

|  |   |
|--|---|
| Wild Senna and Wild Garlic                           | >18.7 cfsm on a frequency of once every 2-10 years  |
| Twisted Sedge/Fern Glade (upper Souhegan only)       | >2.8 cfsm once every 1-3 years (December through April)   |
| Wood Turtle (lower Souhegan only)                    | <5.85 cfsm (June through September)   |
| Wood Turtle (lower Souhegan only)                    | Flow should exceed the average flow of the last two weeks of the previous November (December through February).                                       |
| Fowler's Toad (lower Souhegan only)                  | >2.335 cfsm at least once to fill wetlands (March through May); and >0.175 cfsm at least monthly to maintain breeding pools (June through mid-August) |
| Silver Maple Floodplain Forest (lower Souhegan only) | >11.7 cfsm once every 1-3 years   |
| Sycamore Floodplain Forest (lower Souhegan only)     | >17.5 cfsm once every 1-3 years   |
| Oxbow/Backwater Marsh (lower Souhegan only)          | >3.5 cfsm at least once to fill (March through April)   |

## II. Lessons Learned

- Implementation actions
- Things that work
- Things that don't work
- Effects of various actions
- Factors affecting ability to manage

## II. Lessons

# The pilot program worked

- Study methods defined effective numerical criteria.
- Application of management meets flow goals.
- The pilot identified practical improvement for future applications

## II. Lessons

# Natural Flows

- Natural flows protect ecosystem and support many human uses
- Management using natural flows provides more flexibility for water use than other methods

## II. Lessons

# Criteria drivers

- Flow criteria should be based on the flow-dependent entities
  - Fish (and other aquatic species?)
  - Riparian species
  - Recreation

## II. Lessons

# Lakes and rivers interact

- Storage and releases from lakes affect stream flow
- Lake storage can be used to manage stream flows
- Lake uses and values need to be protected

## II. Lessons

# Getting all interests represented

- We now have a better sense of what features management affect
- Earlier involvement of interest groups
- Improved and shortened plan development

## II. Lessons

# Spinoff benefits

- Strengthened gage network
- Principles for water resource management
- Specific lake management criteria

## II. Lessons

# Inadequate monitoring

- Not enough monitoring to define baseline and trend conditions
  - Fish
  - Riparian vegetation and wildlife

# III. Impacts

- Instream Flow protection goals
- Are dam releases effective?
- Water users
- Fish and riparian species
- Recreational
- Hydropower
- Water quality
- State agencies

### III. Impacts

## Goals for ISF protection

- Biology – water quality standards for biological integrity
- Social – recreation and water use
- Hydrology – mimic the natural pattern
- Legal – Surface Water Quality Rules and Instream Flow Rules; Rivers Act and pilot program legislation

### III. Impacts

## Fish and riparian species

- Need baseline and long-term monitoring
- Assumption is that mimicking natural flows will support the expected species
- (Riparian plant and wildlife communities follow the same assumption)
- Fish are assessed by comparison with the Target Fish Community

### III. Impacts

## Water users

- Water users have effects on flows and are also affected by management
- Most water users have few requirements
- Most management where there is:
  - Consumptive uses
  - Inducing recharge
- Costs - variable
- Survey conducted February 2015

### III. Impacts

## Recreation - boating

- No obvious impacts
- Long-term tracking
- Availability and duration of flows that meet boating preferences

# IV. Plan for other Designated Rivers

- Process
- Methods
- Priorities
- Resources needed
- Schedule

#### IV. Plan for other Rivers

## Methods and Process

- Use the same methods for determining protected flow criteria
- Different process
  - focus the studies
  - consultants
  - public input

#### IV. Plan for other Rivers

## Priority rivers

- 45 out of 1000 designated river miles done
- Priorities - different criteria than the pilot
- Will the legislature pick the progression or leave the decision to NHDES?

#### IV. Plan for other Rivers

## Resources needed

- Two additional staff
- Funding :
  - dam retrofits
  - consultants for PISF studies
  - independent reviews
  - river models



# V. Legislation

- Changes to Rivers Act–RSA 483
- Changes to Water Conservation Act–RSA 485.61
- Replace pilot program legislation?

# Recommendations

- Legislation changes
- Develop fish data statewide
- Review gage data relative to ISF needs
- Long-term monitoring
- Same ISF assessment methods
- ISF studies by consultants; WMP by DES
- Develop criteria for adaptive management

A photograph of a man fishing in a river. The man is wearing a blue cap, a dark vest over a light shirt, and blue jeans. He is standing on a rocky bank with some greenery. The river is dark and reflects the surrounding trees. The text is overlaid on the right side of the image.

# Comments or questions?

Mr. Wayne Ives, P.G.  
NHDES  
P.O. Box 95  
29 Hazen Drive  
Concord, NH 03302-0095

Phone and email:

271-3548

[Wayne.Ives@des.nh.gov](mailto:Wayne.Ives@des.nh.gov)

# Souhegan Protected Flows

**Table 1 - Instream Protected Flows for the Segments of the Souhegan River Designated as Protected Pursuant to RSA 483:15, XIII**

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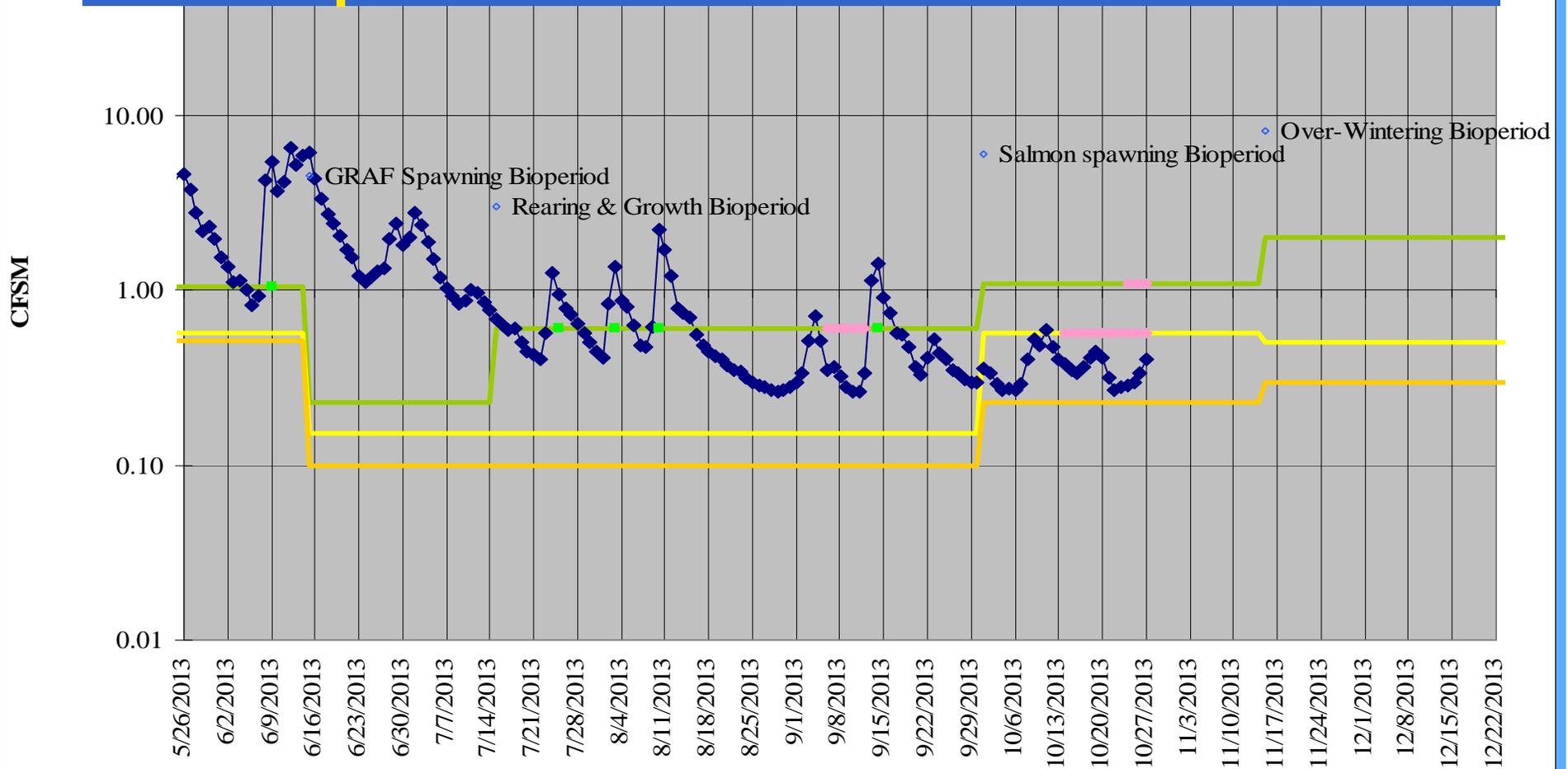
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| Dec 2 – Dec 31                                   | Wood Turtle hibernation                 |                  |                   |                    |                           |                              |                     |                      |                           |                              |                 |                  |                           |                              |

**Bold values are upper limits for instream flow for protection of GRAF spawning. Flows should not be created that exceed these magnitudes and durations.**

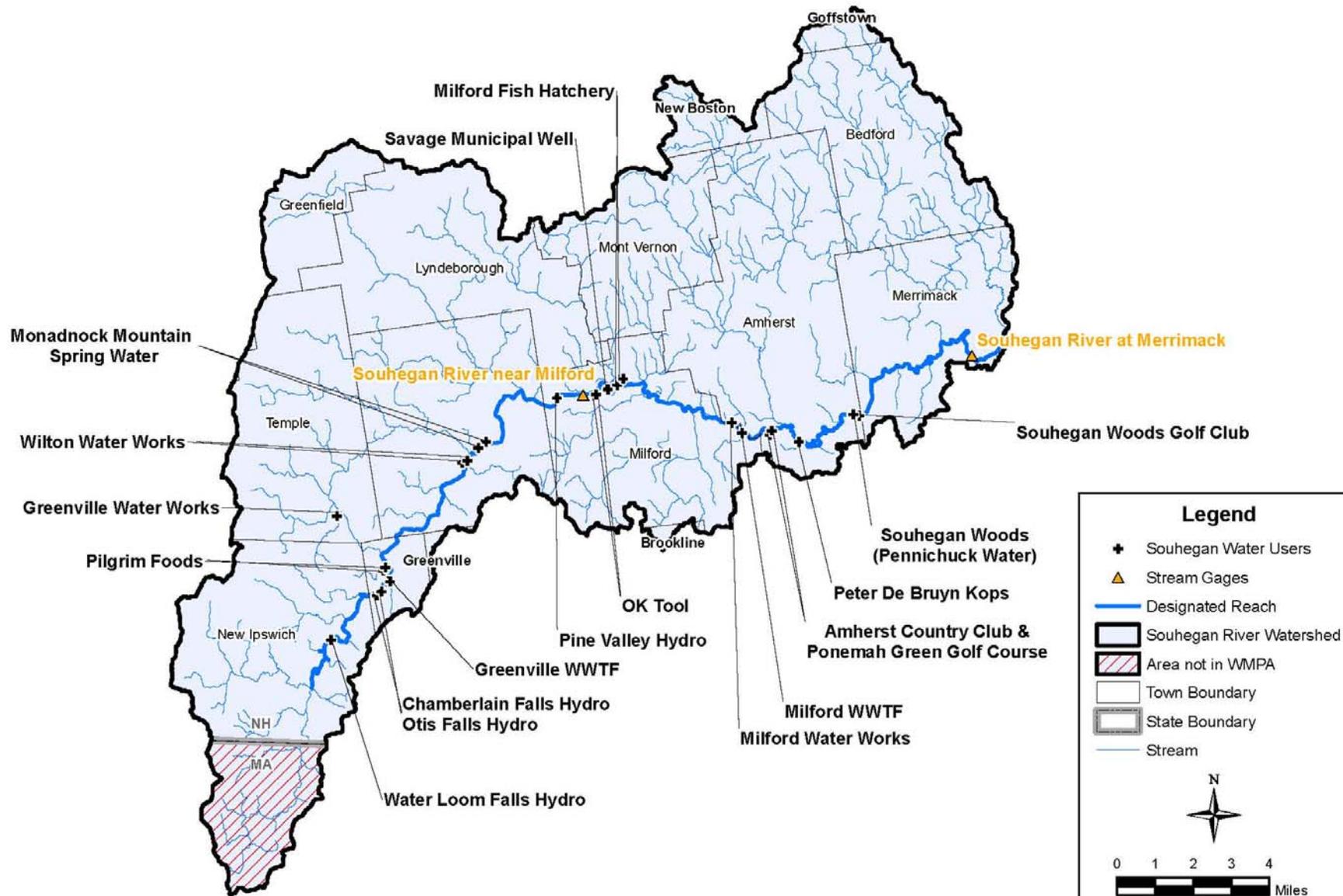
## Souhegan Protected Instream Flows for Natural Communities, Wildlife Habitats and Rare, Threatened or Endangered Wildlife and Plants

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| Wood Turtle (lower Souhegan only)                    | <5.85 cfsm (June through September)   |
| Wood Turtle (lower Souhegan only)                    | Flow should exceed the average flow of the last two weeks of the previous November (December through February).                                       |
| Fowler's Toad (lower Souhegan only)                  | >2.335 cfsm at least once to fill wetlands (March through May); and >0.175 cfsm at least monthly to maintain breeding pools (June through mid-August) |
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| Sycamore Floodplain Forest (lower Souhegan only)     | >17.5 cfsm once every 1-3 years   |
| Oxbow/Backwater Marsh (lower Souhegan only)          | >3.5 cfsm at least once to fill (March through April)   |

# Assessing hydrologic conditions by tracking daily stream flow and comparing with protected instream flow values.



- |                               |                              |                             |                             |
|-------------------------------|------------------------------|-----------------------------|-----------------------------|
| ◆ Stream flow (cfsm)          | — Common protected flow      | — Critical protected flow   | — Rare protected flow       |
| ◆ Common Persistent event     | ◆ Critical Persistent event  | ◆ Rare Persistent event     | ◆ Common Catastrophic event |
| ◆ Critical Catastrophic event | ◆ Rare Catastrophic event    | ◆ Common Reset              | ◆ Critical Reset            |
| ◆ Rare Reset                  | ◆ Over-Wintering Bioperiod   | ◆ Spring Flood Bioperiod    | ◆ Shad Spawning Bioperiod   |
| ◆ GRAF Spawning Bioperiod     | ◆ Rearing & Growth Bioperiod | ◆ Salmon spawning Bioperiod |                             |



**Figure 2. Souhegan Affected Water Users**

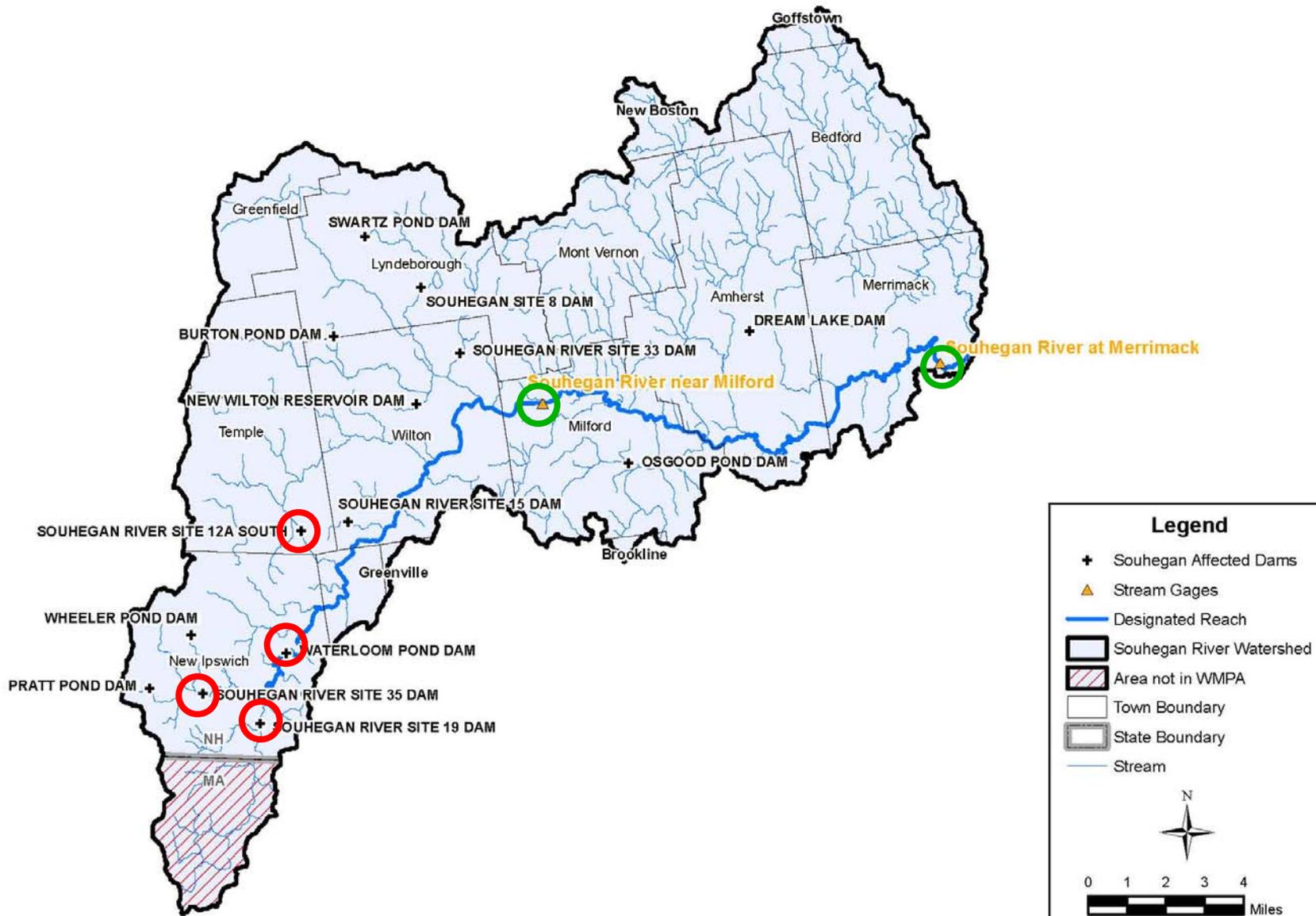


Figure 3. Location Map of Souhegan Affected Dams.

# Lamprey DR

## Protected Instream Flows

| Lamprey Protected Instream Flows for Fish |                          |                  | Common Flow       |                    |                           |                              | Critical Flow       |                      |                           |                              | Rare Flow       |                  |                           |                              |
|---|--------------------------|------------------|-------------------|--------------------|---------------------------|------------------------------|---------------------|----------------------|---------------------------|------------------------------|-----------------|------------------|---------------------------|------------------------------|
| Time of Year                              | Controlling IPUOCR Flows | Bioperiod        | Common Flow (cfs) | Common Flow (cfsm) | Allowable Duration (days) | Catastrophic Duration (days) | Critical Flow (cfs) | Critical Flow (cfsm) | Allowable Duration (days) | Catastrophic Duration (days) | Rare Flow (cfs) | Rare Flow (cfsm) | Allowable Duration (days) | Catastrophic Duration (days) |
| Dec 9 – Feb 28                            | Flow                     | Overwintering    | 238               | 1.3                | 20                        | 57                           | 110                 | 0.60                 | 10                        | 37                           | 73              | 0.40             | 7                         | 30                           |
| Mar 1 – May 4                             | Flow                     | Spring Flood     | 622               | 3.4                | 14                        | 42                           | 238                 | 1.3                  | 10                        | 19                           | 146             | 0.80             | 3                         | 9                            |
| May 5 – Jun 19                            | Shad spawning            | Clupeid Spawning | 143               | 0.78               | 13                        | 28                           | 62 / 156            | 0.34 / 0.85          | 5                         | 13                           | 57 / 242        | 0.31 / 1.3       | 4                         | 10                           |
| Jun 20 – Jul 4                            | GRAF spawning            | GRAF Spawning    | 101 / 101         | 0.55 / 0.55        | -- / 11*                  | 15*                          | 18 / 156            | 0.10 / 0.85          | 5*                        | 10*                          | 16 / 242        | 0.087 / 1.3      | 2*                        | 3*                           |
| Jul 5 – Oct 6                             | Common Shiner            | Rearing & Growth | 104               | 0.57               | 46                        | 82                           | 18                  | 0.10                 | 15                        | 32                           | 16              | 0.087            | 5                         | 15                           |
| Oct 7 – Dec 8                             | Atlantic Salmon          | Salmon Spawning  | 90                | 0.49               | 17                        | 55                           | 40                  | 0.22                 | 11                        | 33                           | 20              | 0.11             | 6                         | 11                           |

### Lamprey Protected Instream Flows for Natural Communities, Wildlife Habitats and Rare, Threatened or Endangered Wildlife and Plants

|  |  |
|--|--|
| Wood Turtle - Winter Survival  | >130 cfs seasonal mean - December 1 through February 28                        |
| Herbaceous Low Riverbank, mannagrass, hempweed - habitat maintenance | >500 cfs for one week or more - December 1 through April 30                    |
| Riverweed, Knotty Pondweed - growth and development                  | >100 cfs seasonal mean - May 1 through June 30                                 |
| Wood Turtle - avoid nest flooding during management                  | <500 cfs daily mean - June 1 through October 15, except for natural events     |
| Floodplain vernal pools - protection/isolation                       | <1,500 cfs daily mean - March 15 through July 31, except for natural events    |
| Herbaceous Low Riverbank - growth and development                    | < or = 60 cfs daily mean - August through September, except for natural events |

### Lamprey Protected Instream Flows for Boating

|                          |           |
|--------------------------|-----------|
| Boating recreational use | >=275 cfs |
|--------------------------|-----------|

# Assessing hydrologic conditions by tracking daily stream flow and comparing with protected instream flow values.

Lamprey PISF tracking

