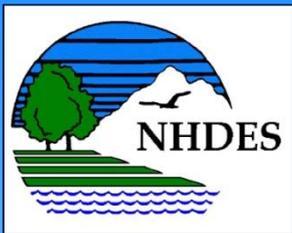
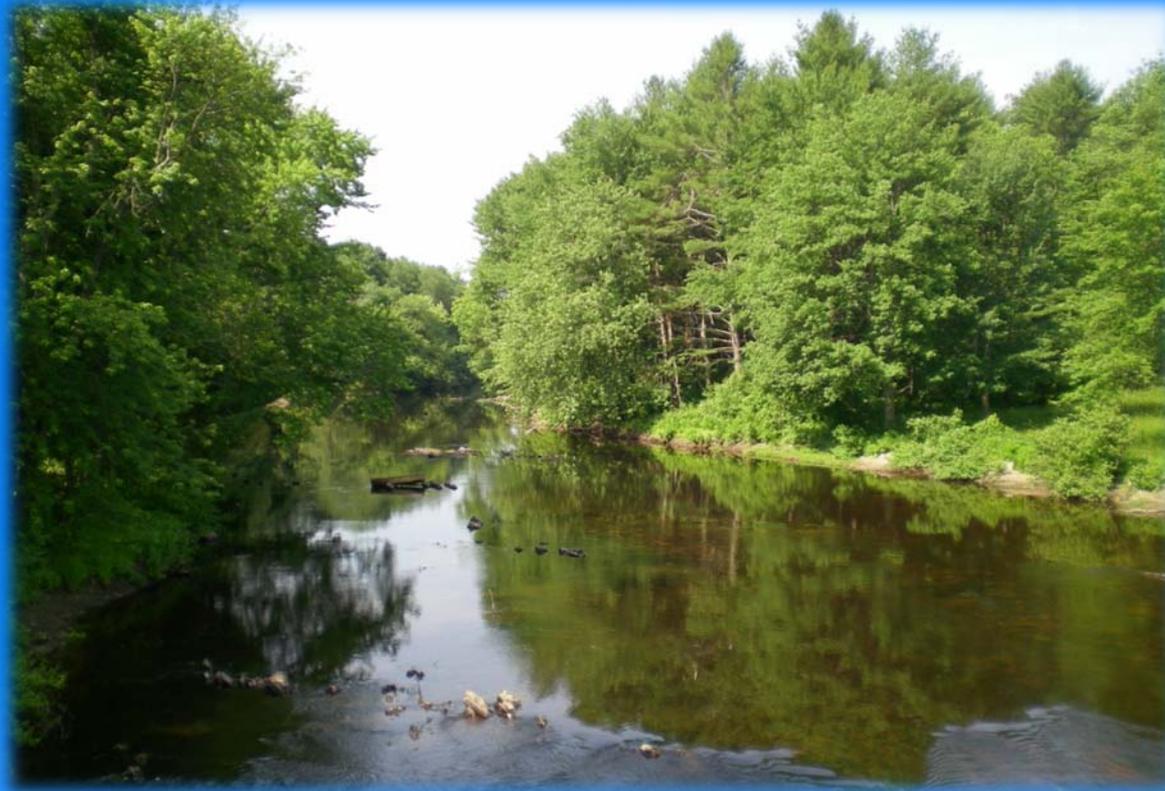


# Lamprey River WMPAAC Meeting July 9 2010



# Lamprey River Water Management Plan

- Introduction
- Acceptance of meeting minutes
- Lamprey Instream Flow program
- Proposed Lamprey Protected Instream Flows
- Water management
  - What is possible to manage?
  - Volume of flow needed
  - Lake level impacts and ramping rates

# Lamprey River Water Management Plan

- **Water Management Plans**
  - **Conservation Plans**
  - **Dam Management Plans**
  - **Water Use Plans**
- **Moving Forward**

# **The Lamprey ISF Program**

- 1) RSA 483 – River Management and Protection Program**
- 2) Laws of 2002, Chapter 278 – Pilot ISF**
- 3) The ISF Rules contain the requirements, drawn from legislation, for defining and establishing the PISFs**

# RSA 483:9-c Complement Surface Water Quality Standards\*

- **maintain water for instream public uses**
- **complement and reinforce** existing state and federal water quality laws
- maintain the chemical, **physical, and biological integrity** of surface waters
- **protection and propagation** of fish, shellfish and wildlife, and for recreation
- **support and maintain** a balanced, integrated, and adaptive **community of organisms**

\*ALL rivers have these narrative protected flows under WQS.

# Natural Flow Paradigm

- Aquatic life is adapted to natural conditions with patterns of high and low flows
- Expect good years and bad years for each species (paddler)
- Low flows and floods are expected to occur within the range of natural variability
- Variability, not just volume, is important to support the ecological integrity

# NFP Applied to other Protected Entities

## NFP is equivalent to EPA's reference condition approach for WQS:

- Best system is one without human influence
- Estimate parameters for unmodified system (Target Fish Community, natural daily hydrograph)
- Determine acceptable deviations from the unmodified system
- Set protected flows at maximum acceptable deviation and manage for that

# Generalized Process of Pilot Project

## PISF Study

- Define protection goals
- Assess river conditions
- Define conditions to meet goals
- Establish numerical flow standards

## WMP

- Evaluate problem reaches
- Evaluate management options
- Integrate options into a plan
- (Implement plans)

# Proposed Protected Instream Flows

## Proposed Protected Instream Flows presented in the Final Lamprey River Protected Instream Flow Report

Issued: July 13 2009



FINAL  
Lamprey River  
Protected Instream Flow Report

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13 July 2009

# Proposed Protected Instream Flows

**Table ES-1 - Instream protected flows for the segments of the Lamprey River**

**Designated as protected pursuant to RSA 483:15, XIII.**

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 / <b>101</b>	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

**Bold values are upper limits for instream flow for protection of GRAF spawning. Management activities should not create flow that exceed these magnitudes and durations.**

Watershed area for calculating cfsm is 183 square miles at the index location used. Index location is the gage USGS

01073500 LAMPREY RIVER NEAR NEWMARKET, NH

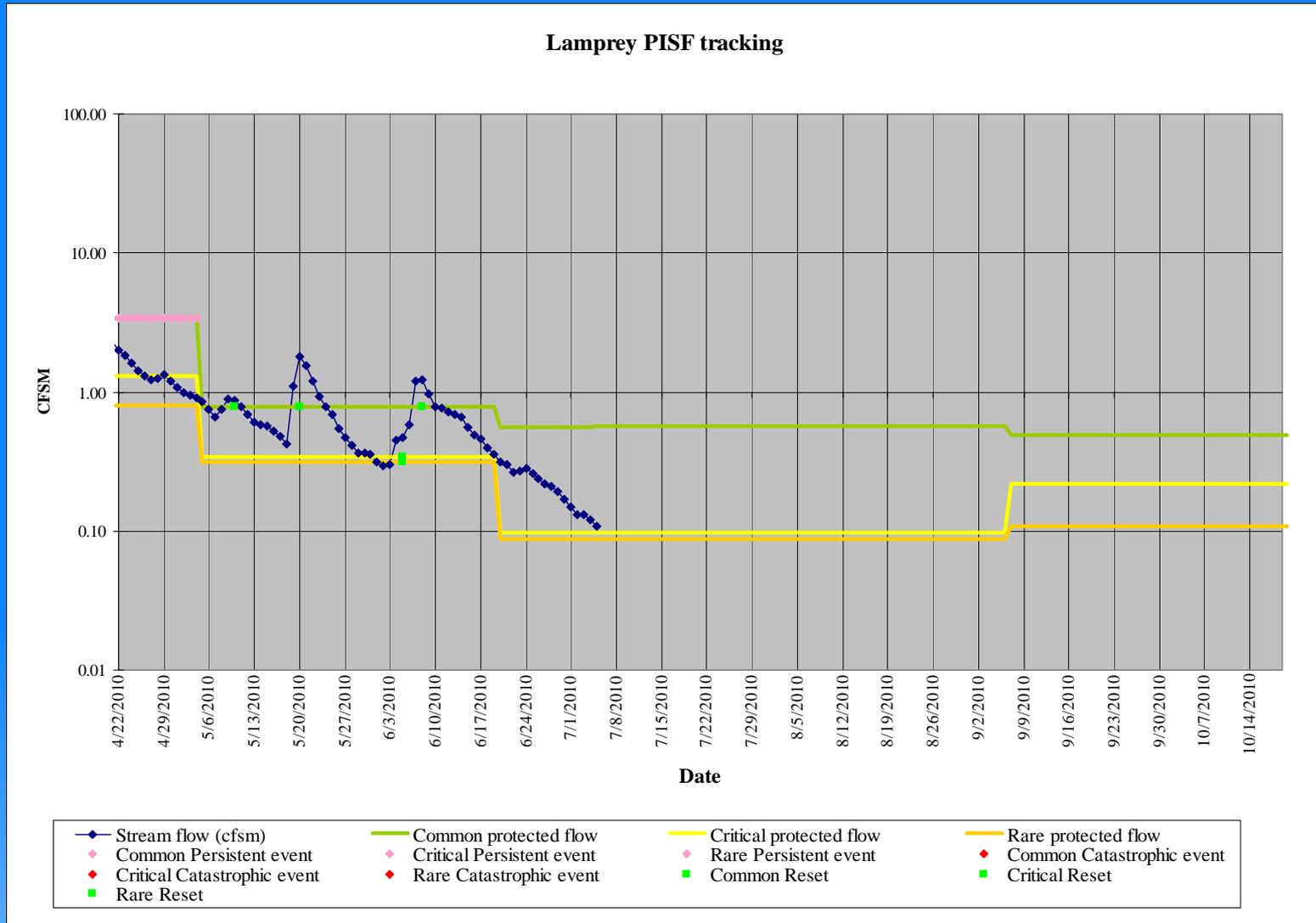
-- No Common Flow Allowable duration is described for this bioperiod because high flows and Catastrophic durations are limiting.

\* GRAF Spawning and Clupeid Spawning bioperiods partly overlap, so durations during this bioperiod begin counting May 5 (previous bioperiod) but apply only during this bioperiod.

# Proposed Protected Instream Flows

<b>Lamprey Protected Instream Flows for Natural Communities, Wildlife Habitats and Rare, Threatened or Endangered Wildlife and Plants</b>	
Wood Turtle - Winter Survival	>130 cfs seasonal mean - December 1 through February 28
Herbaceous Low Riverbank, managrass, 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
<b>Lamprey Protected Instream Flows for Boating</b>	
Boating recreational use	≥275 cfs

# Proposed Protected Instream Flows



# Proposed Protected Instream Flows

## Common Flow Threshold:

- corresponds to the highest habitat magnitude that occurs with regular frequency.
- is not exceeded very often and incrementally higher habitat thresholds increase the cumulative frequency of events under-the-threshold at much lower rate than for the common threshold.
- near optimal habitat availability conditions.

# Proposed Protected Instream Flows

## Critical Flow Threshold:

- corresponds to the first habitat threshold higher than that of the rare habitat magnitude.
- less habitat availability than that provided by the common flow, but this habitat magnitude is not unusual.

# Proposed Protected Instream Flows

## Rare Flow Threshold:

- corresponds to the highest habitat magnitudes that occur far apart in time.
- exceeded very often.
- incrementally higher habitat thresholds increase the cumulative frequency of events under-the-threshold at much higher rate.
- habitat availability is severely reduced and very uncommon.

# Proposed Protected Instream Flows

## Flow Duration Thresholds:

- **Allowable** – consecutive days with flow below protected magnitude for ordinary conditions – no flow management.
- **Catastrophic** - consecutive days with flow below protected magnitude for unacceptable conditions – trigger management.
- **Persistent** – longer than allowable, but shorter than catastrophic - trigger management after 3<sup>rd</sup> consecutive year.

# Proposed Protected Instream Flows

## Critical and Rare:

- **Critical and Rare events represent acute impacts on fish habitat**
- **Loss of Common Flows is a chronic problem with impacts accumulating over years**
- **Manage the Critical and Rare events and track the Common events for possible management**

# What is needed to meet PISFs?

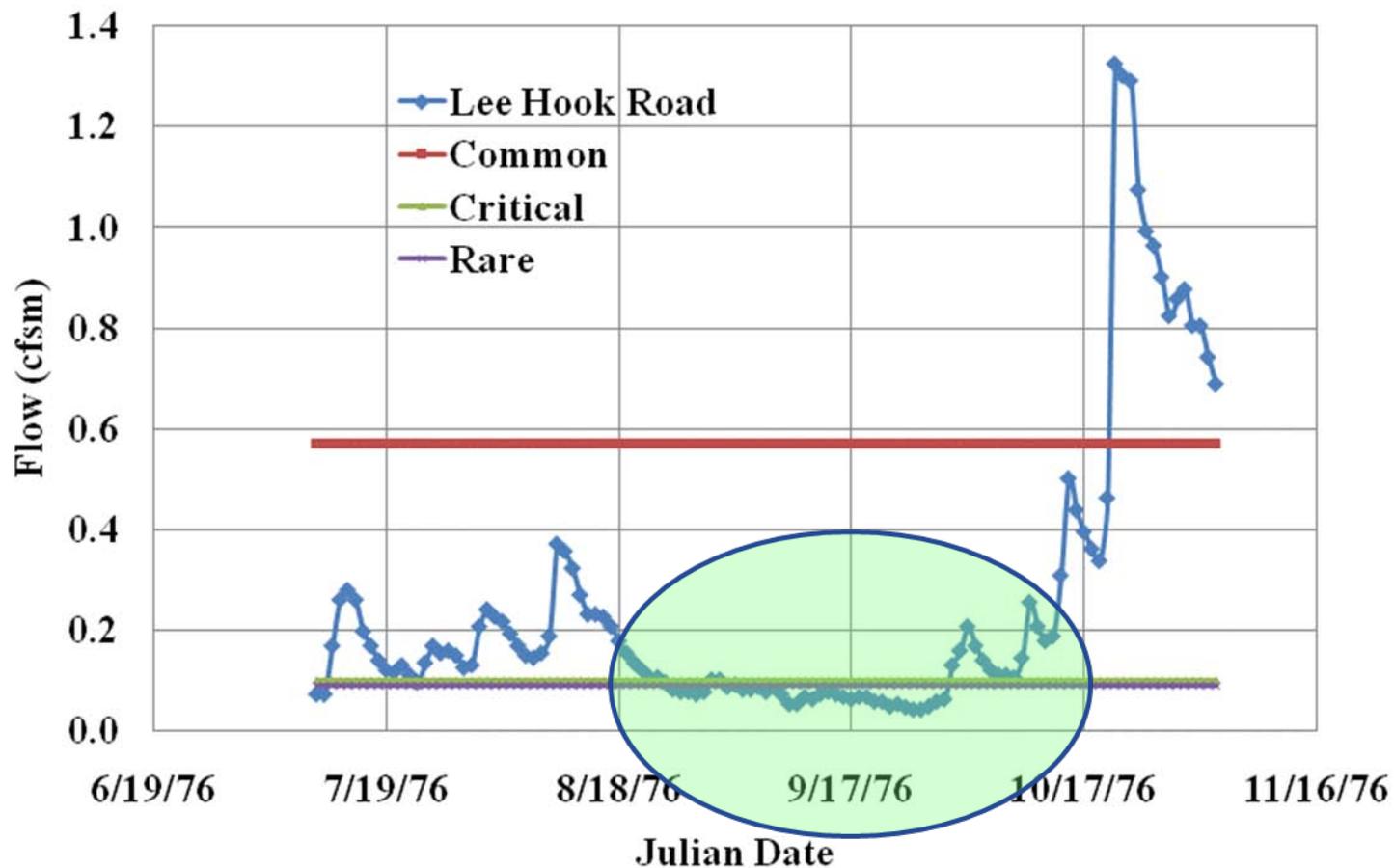
- **Thirty year record for each bioperiod**
- **Frequency analysis for events not meeting PISFs for persistent or catastrophic durations**
- **Comparison of flow volumes that meet at least 90% of Critical and Rare occurrences**
- **Sum of flow volumes for a possible multiple-event year.**

# Task 8 Analyses

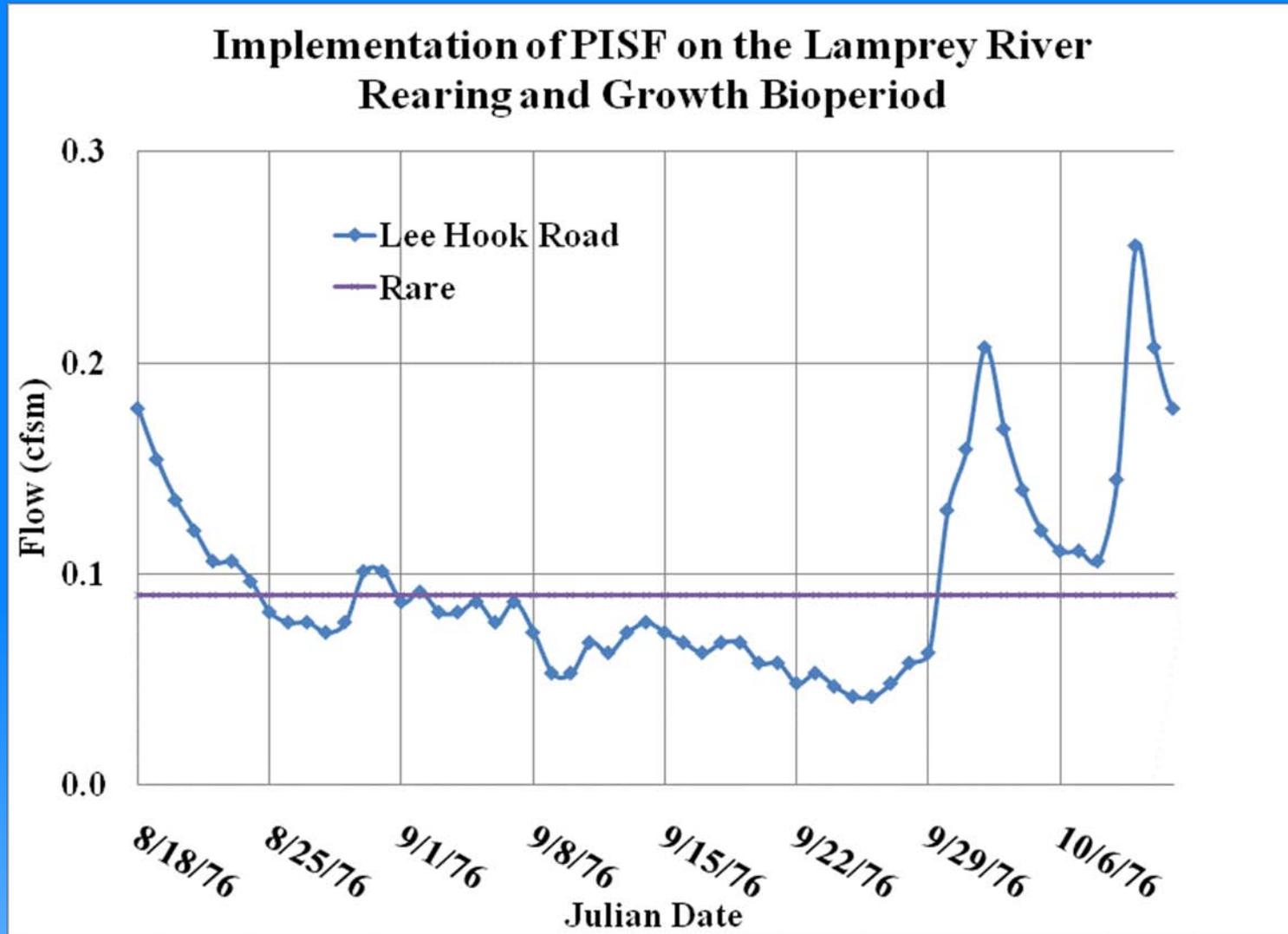
- **Develop long term river flow records**
- **Compare the PISF to river flows**
- **Identify the frequencies of not meeting the protected instream flows**
- **Develop relief flow volume distributions**
- **Analysis performed by UNH (Tom and Joel Ballestero along with Jennifer Jacobs)**

# Short Hydrograph Example

Implementation of PISF on the Lamprey River  
Rearing and Growth Bioperiod

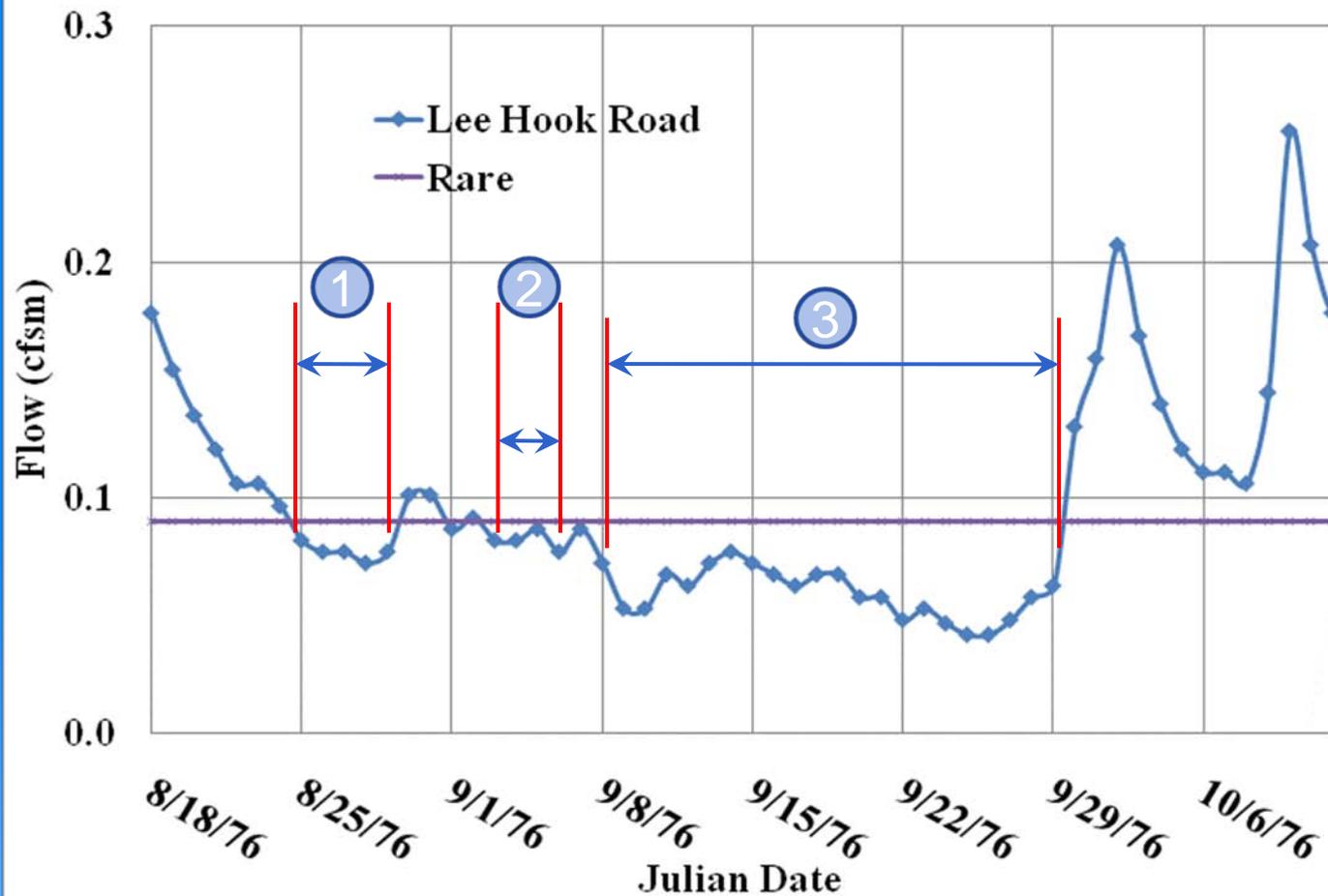


# Amplified Rare PISF and Flows



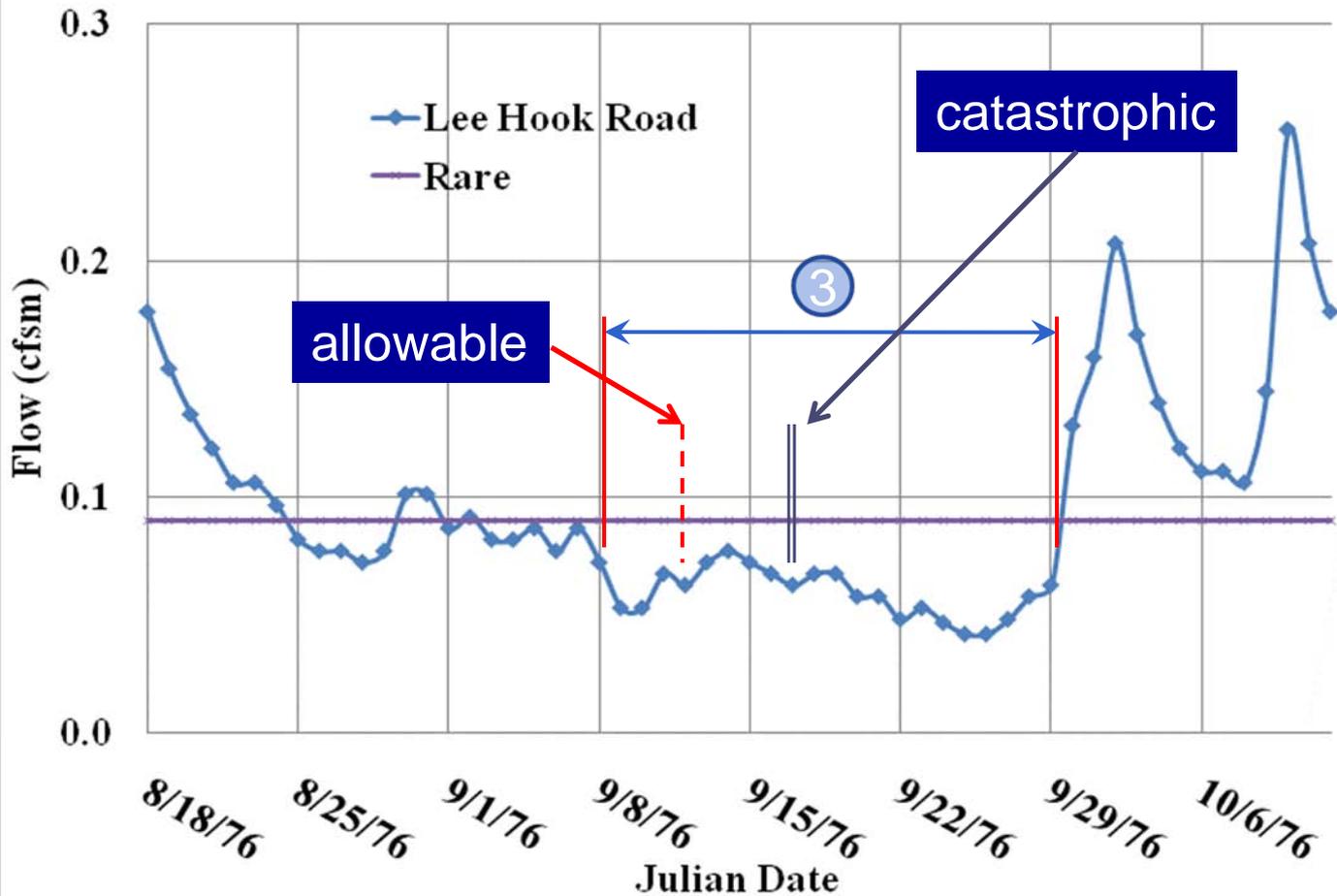
# Deficit Periods

Implementation of PISF on the Lamprey River  
Rearing and Growth Bioperiod



# Deficit Durations

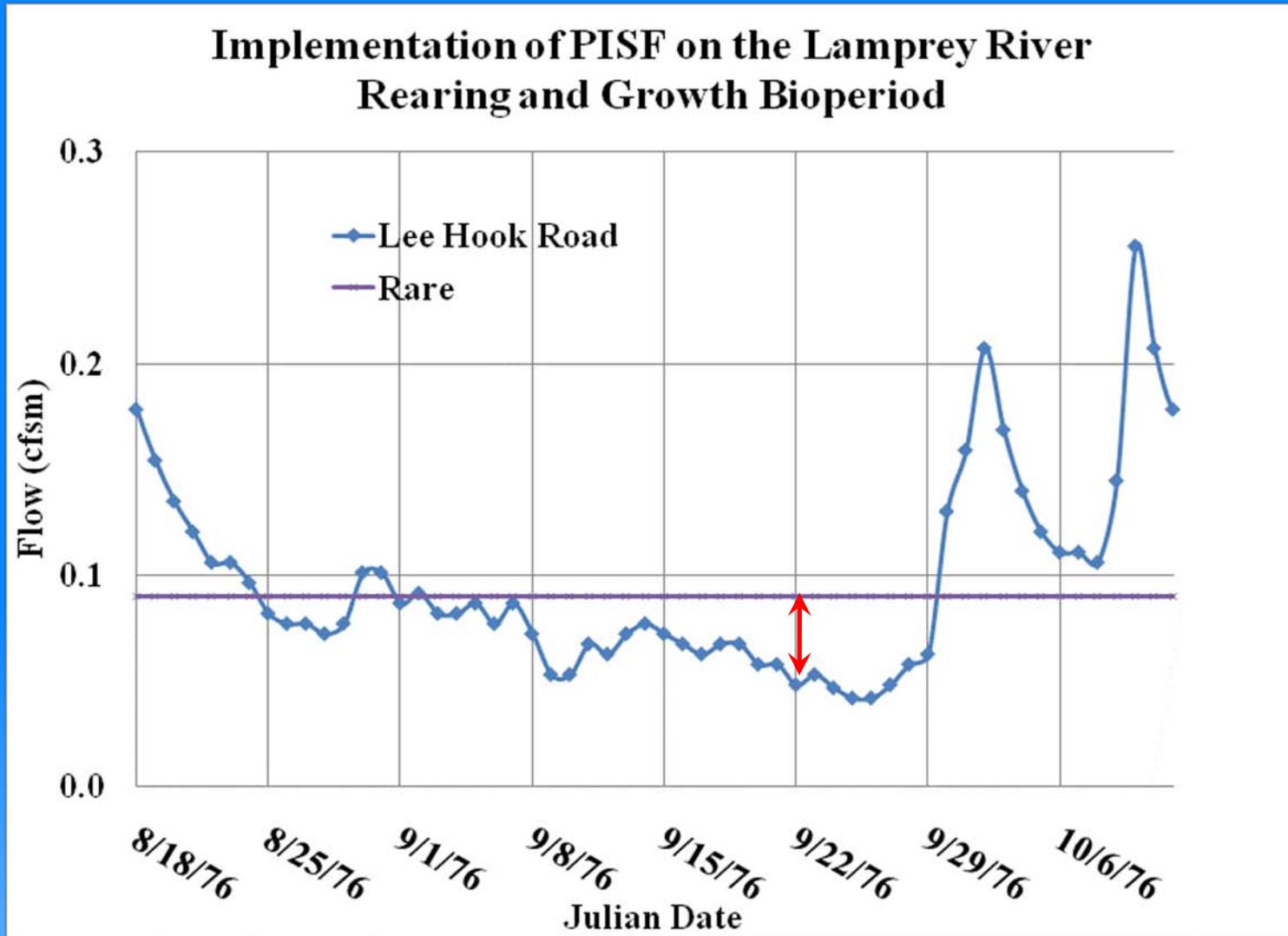
## Implementation of PISF on the Lamprey River Rearing and Growth Bioperiod



# The Relief Flows

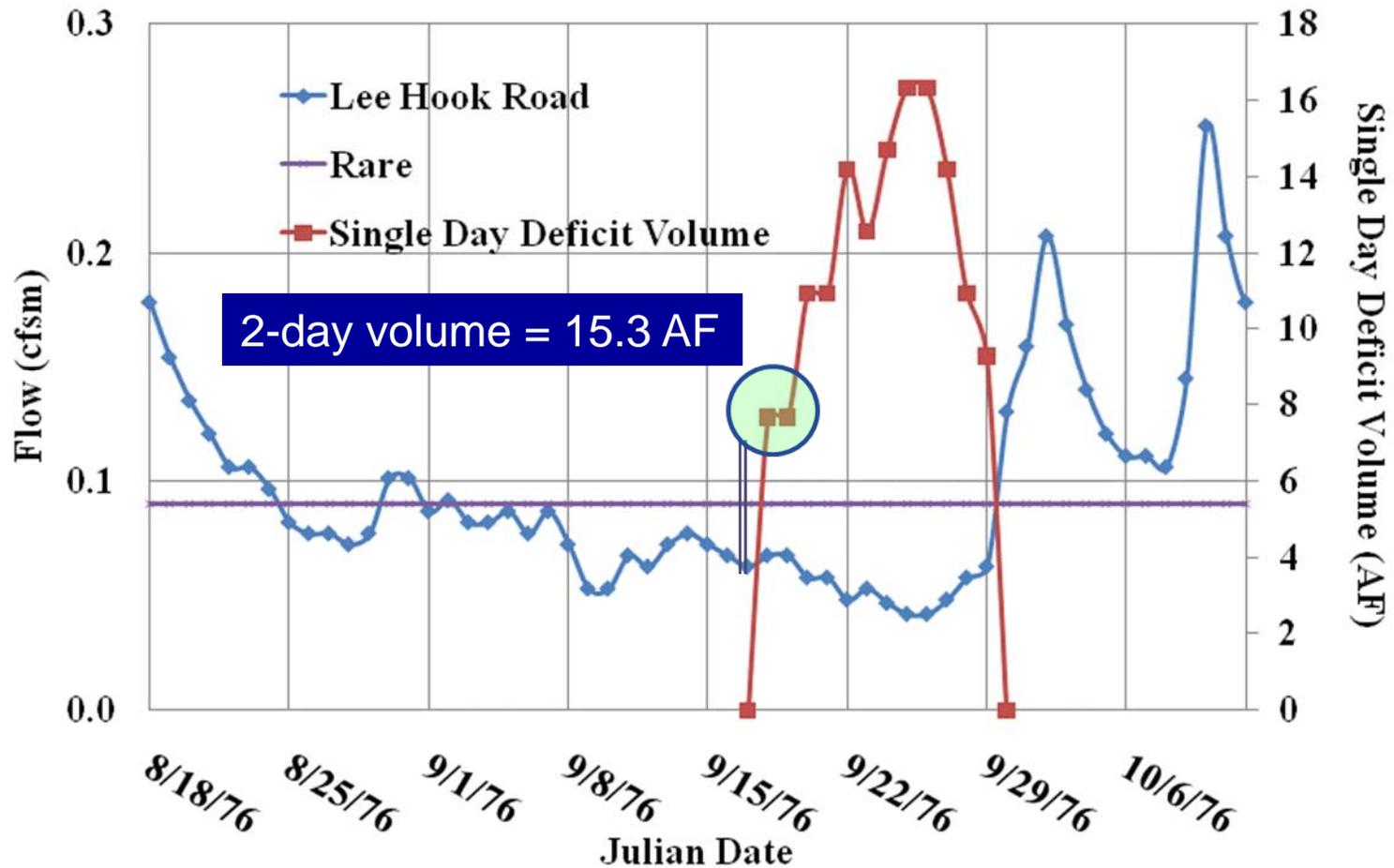
- That flow necessary to increase the Lamprey River flow to at or just above the PISF
- When integrated over one day, this determines the relief flow volume for that day.

# Daily Relief Flow Volume



# Daily Relief Flow Volume History

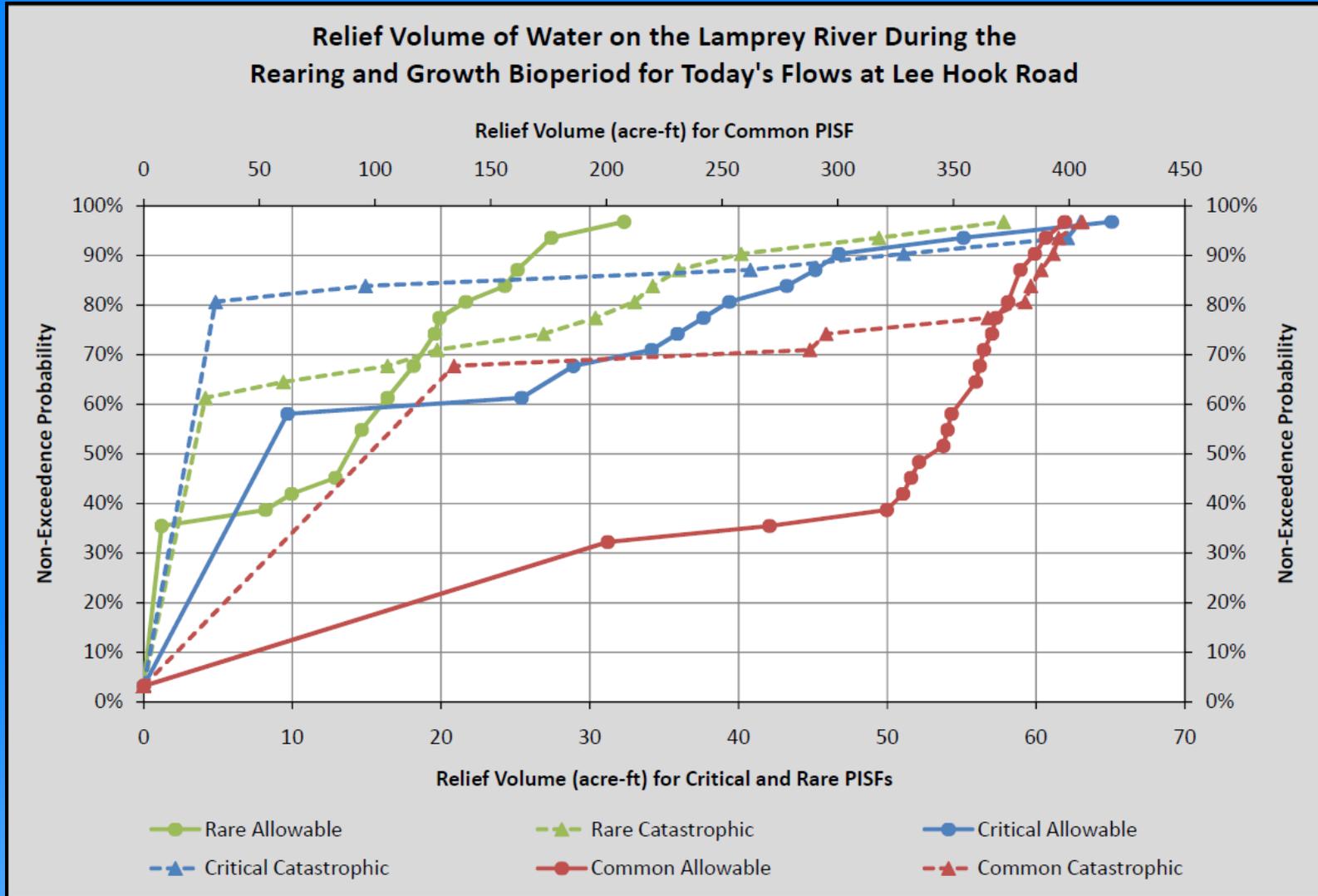
## Implementation of PISF on the Lamprey River Rearing and Growth Bioperiod



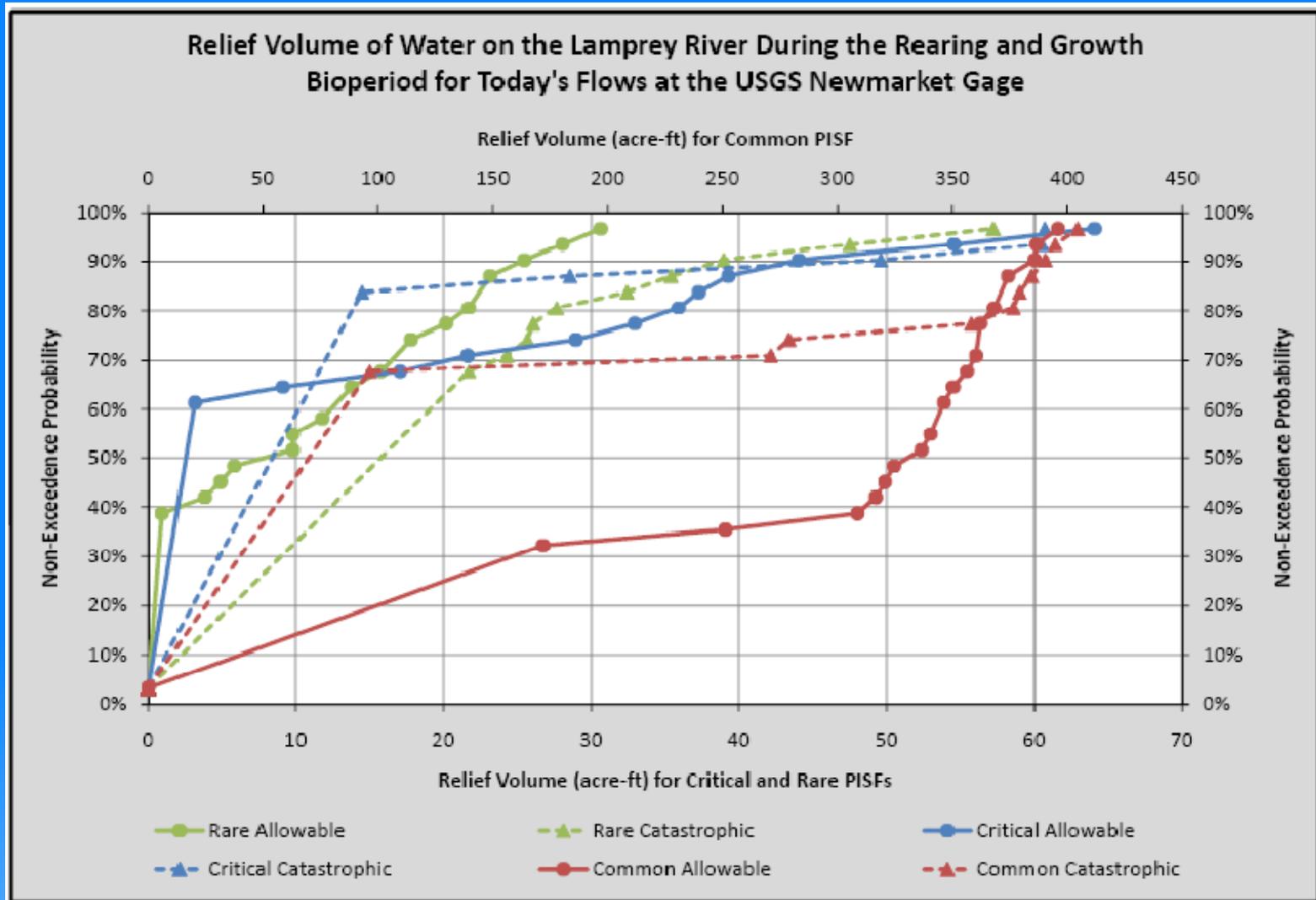
# Relief Flow Concept

- **Break the low flow by raising the river flow to at or just above the PISF for at least one day**
- **Plan around two successive days of relief flow volume**

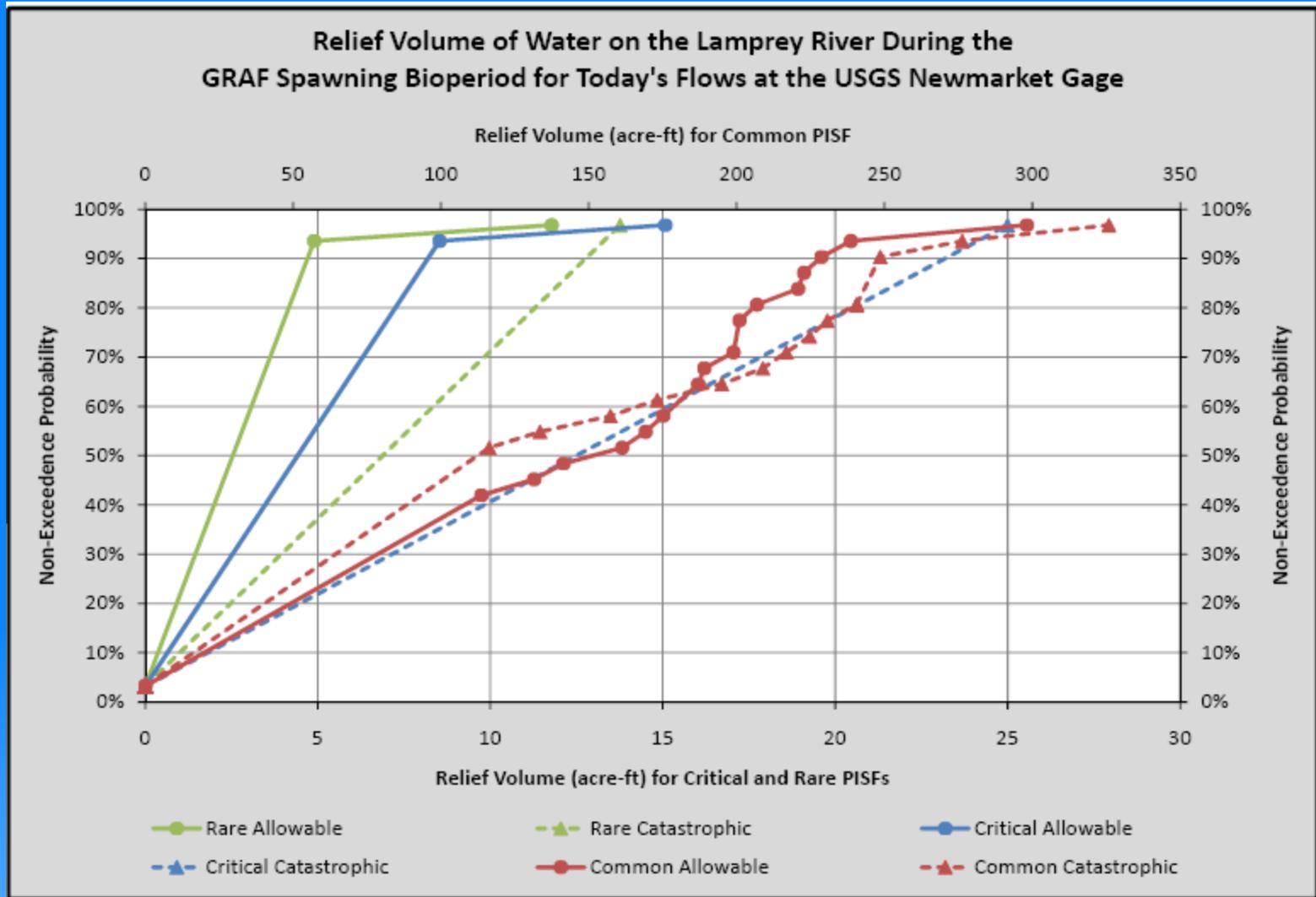
# Distribution of the Two-Day Relief Flow Volumes



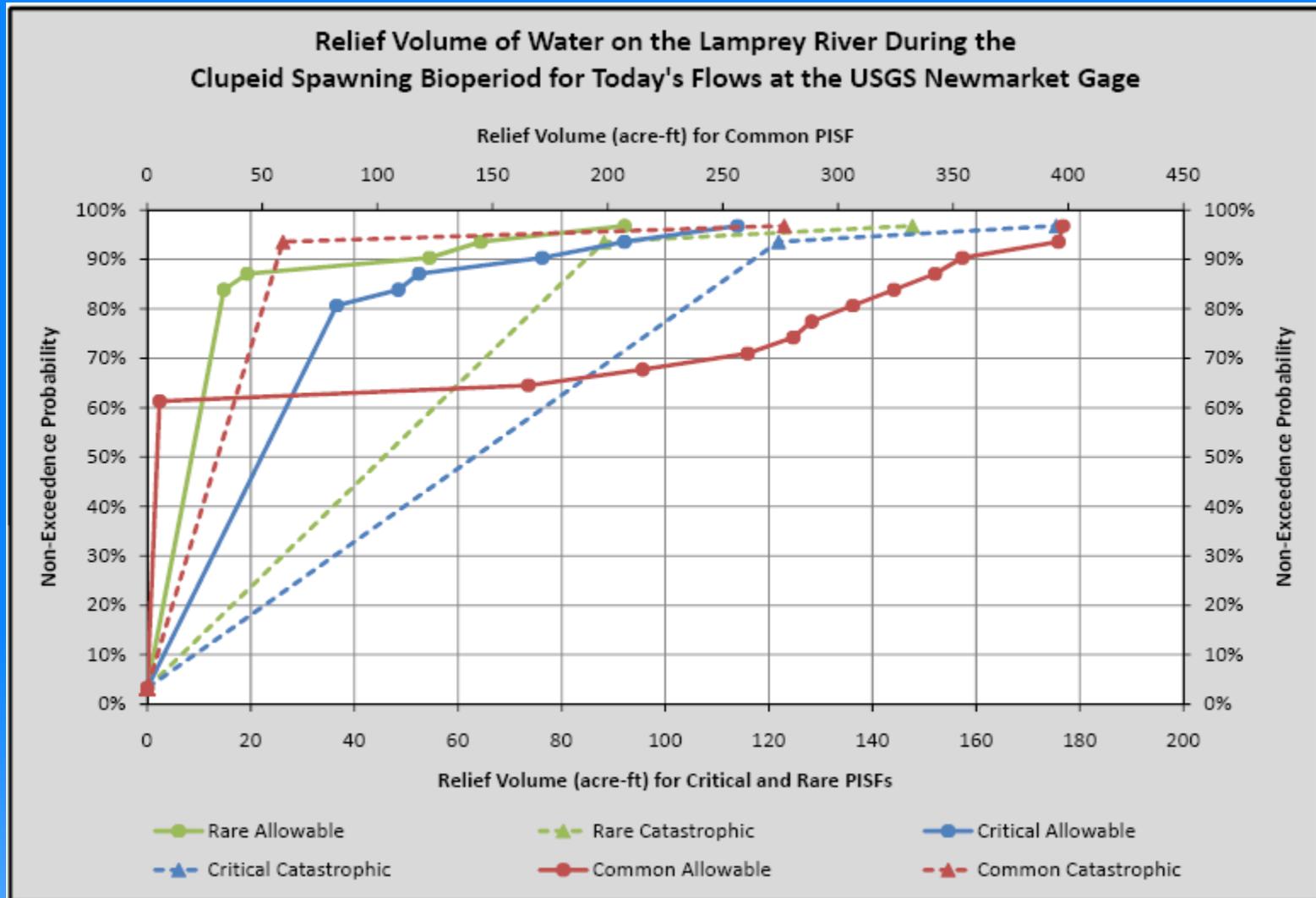
# Rearing & Growth



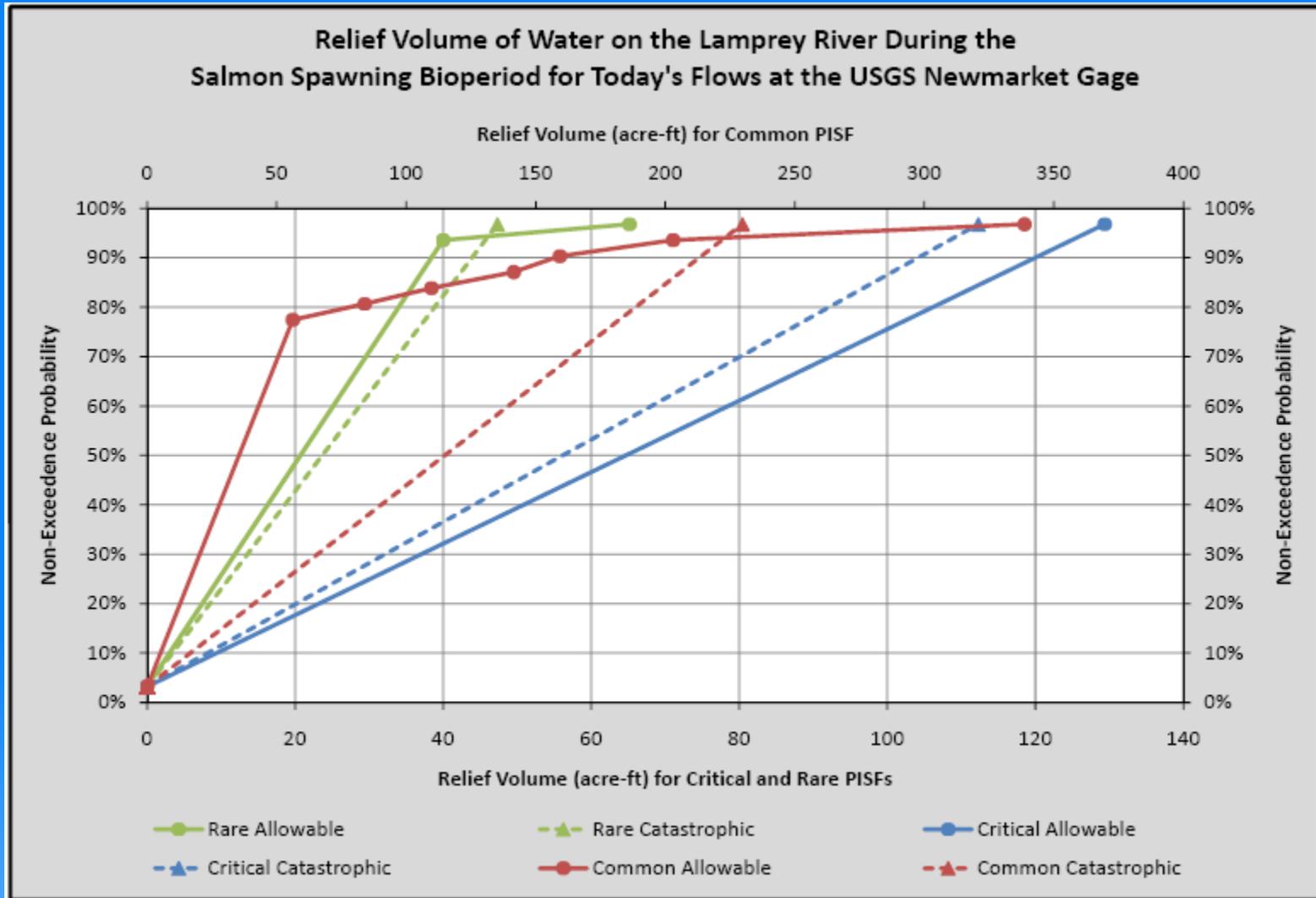
# GRAF Spawning



# Clupeid Spawning



# Salmon Spawning



# **Water Management Plan**

## **WMPs to Implement PISFs**

- **Maintain flows for instream public uses**
- **Support off-stream public water supplies and agriculture**
- **Reduce impacts, spread impacts, offset impacts**
- **Towards maintaining the natural variability and range of flows**

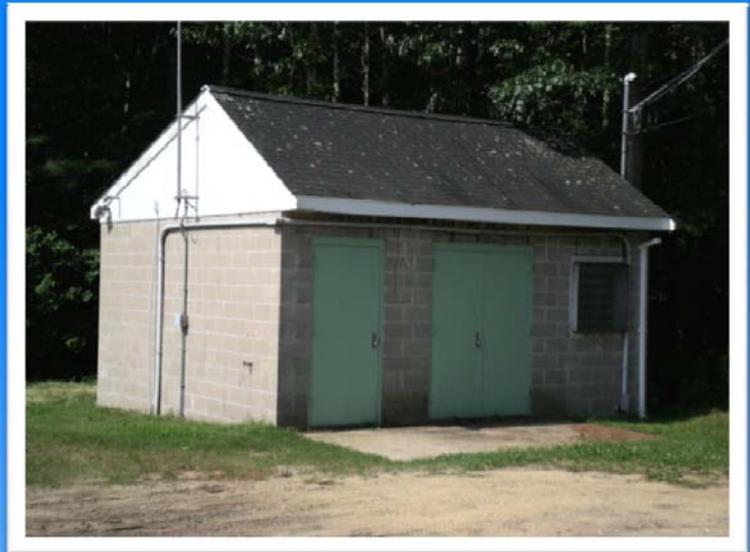
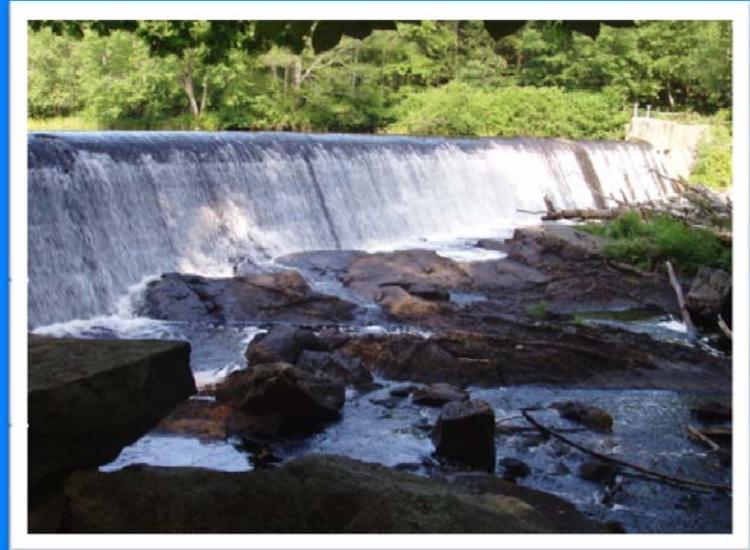
# Water Management Plan

## Who's affected?

- Dam Owners
- Water Users

## What's the Plan?

- Conservation
- Dam Management
- Water Use



# Water Management Plan

## Who's affected?

Dam Owners – an affected dam owner (ADO) means an owner of a dam with an impoundment with a surface area greater than 10 acres in the watershed of the designated river. (Env-Ws 1902.02)



Bunker Pond Dam - Epping

# **Water Management Plan**

## **Affected State Owned Dams**

- **Beaver Pond Dam - DRED (50 acres)**
- **Bunker Pond Dam - DB (29 acres)**
- **Doles Marsh Dam - F & G (25 acres)**
- **Lucas Pond Dam - F & G (40 acres)**
- **Meadow Lake Dam - DRED (17 acres)**
- **Mendums Pond Dam - DB (265 acres)**
- **North River Pond Dam - DB (80 acres)**
- **Pawtuckaway Lake Dams and Dikes (Dollof, Drowns, and Gove) - DB (900 acres)**

# Water Management Plan

## Affected Municipally Owned Dams

- **Freeses Pond Dam**  
Deerfield (55.3 acres)
- **Hoar Pond Dam**  
Epping (26 acres)
- **Thurston Pond Dam**  
Deerfield (13.5 acres)
- **Wiswall Dam**  
Durham (30 acres)



Freeses Pond Dam

# Water Management Plan

## Affected Privately Owned Dams

- Deer Pond Dam  
(38 acres)
- Nottingham Lake Dam  
(41 acres)
- Onway Lake Dam  
(192 acres)
- Piscassic Ice Pond Dam  
(13.7 acres)
- Socha Pond Dam  
(30 acres)



Nottingham Lake Dam

# Water Management Plan

## Who's affected?

Water Users – an affected water user (AWU) means: a water user required to be registered under Env-Wr 700, or successor rules, and having a withdrawal or return location within 500 ft of a designated river or within 500 ft of a river or stream in its tributary drainage area.



Fremont Road Well - Epping

# Water Management Plan

## Water User Registration and Reporting

No person shall withdraw or discharge a cumulative amount of:

more than 20,000 gallons of water per day, averaged over any 7-day period, or more than 600,000 gallons of water over any 30-day period, at a single real property or place of business without registering the withdrawal or discharge with the department. (RSA 488:3)

# **Water Management Plan**

## **Affected Water Users**

- **Epping Water Works - Public Water Supply**
- **Newmarket Water Works - Public Water Supply**
- **Raymond Water Works - Public Water Supply**
- **Scenic Nursery & Landscaping - Agricultural**
- **University of New Hampshire/Town of Durham Water System - Public Water Supply**

# Water Management Plan

## Affected Water Users

### Annual and Daily Water Use

Affected Water User	Annual Water Use			Daily Water Use		
	High	Low	Average	High	Low	Average
Epping Water Works	0.22	0.14	0.17	0.24	0.08	0.16
Newmarket Water Works	1.16	0.64	0.76	1.77	0.59	0.76
Raymond Water Department	0.50	0.32	0.41	0.62	0.22	0.41
Scenic Nursery & Landscaping	0.02	0.002	0.007	0.05	0.00	0.01
UNH/Durham Water System	0.51	0.00	0.09	1.07	0.00	0.09
Note:						
	All values in cubic feet per second, cfs					
	Daily water use based on monthly data					

# Water Management Plan



# Conservation Plans

## Elements of Individual Plans:

- Identification of water source and uses.
- Description of water use patterns.
- Description of existing water conservation measures.
- Discussion of water conservation alternatives.
- Conservation implementation schedule.

# Conservation Plans

## Basic Water Conservation Requirements:

- **Meter water sources and users.**
- **Maintain all meters.**
- **Read source meters at least once every 30 days and user meters at least every 90 days.**
- **Implement water audit and leak detection programs.**

# Conservation Plans

## Basic Water Conservation Requirements:

- **Estimate unaccounted-for-water and reduce to below 15%.**
- **Implement pressure reduction consistent with industry standards.**
- **Adopt a water rate structure that promotes water conservation.**
- **Implement water conservation educational outreach initiative.**

# Conservation Plans

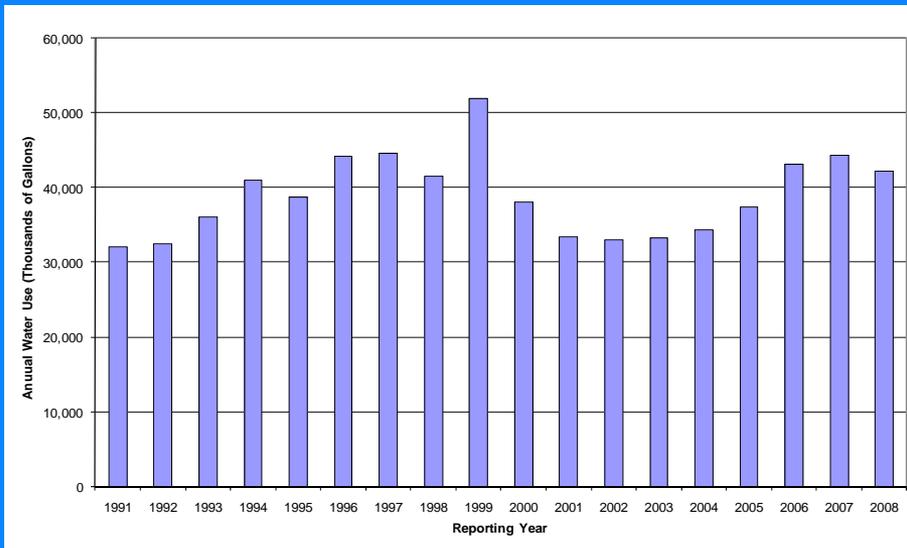
## Epping Water Works

- **Currently obtains water supply from three wells, two near Hoar Pond and one near Fremont Road.**
- **Installing additional water supply well near Hoar Pond.**
- **In support of Large Groundwater Permit application for the new well, Epping submitted proposed Water Conservation Plan to DES in 2008.**

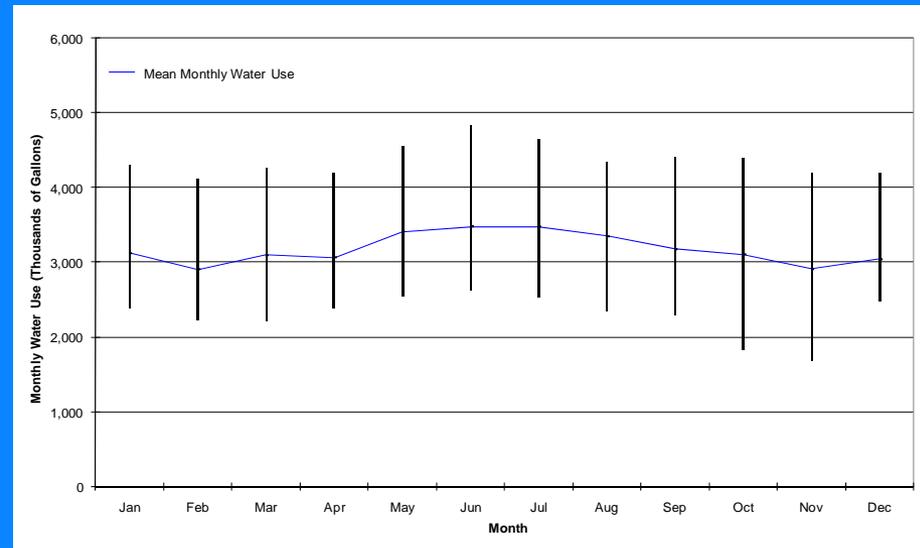
# Conservation Plans

## Epping Water Works

### Annual Water Use 1991 - 2008



### Monthly Water Use 1989 - 2008



	Low	High	Average
<b>(thousand gal)</b>	32,000	51,900	39,000
<b>(cfs)</b>	0.1360	0.2200	0.1650
<b>(cfsm at Packers Falls Gage)</b>	0.0007	0.0012	0.0009

	Low	High	Average
<b>(thousand gal)</b>	1,680	4,840	3,180
<b>(cfs)</b>	0.0840	0.2420	0.1620
<b>(cfsm at Packers Falls Gage)</b>	0.0005	0.0013	0.0009

# Conservation Plans

## Epping Water Works

- Annual water use between 1991 and 2008 increased by 10,225 thousand gallons or 32%. Average increase of 568 thousand gallons or 1.8% per year.
- Maximum mean monthly water use during June and July.
- Daily water use ranged from a maximum of 0.24 cfs, to a minimum of 0.08 cfs, with an average use of 0.16 cfs.

# Conservation Plans

## Conservation Actions for PWSs:

- Management actions taken only during summer/fall bioperiods of lowest flow and highest water use.
- Management actions include:
  - **Alert** at flows below 25 cfs.
  - Outdoor Water Use **Restriction** at flows below Critical (18 cfs).
  - Outdoor Water Use **Ban** when flows fall below 16 cfs for greater than 15 days.

# Dam Management Plans

## Elements of Individual Plans:

- Summarize dam characteristics, operations and limitations.
- Assess potential water availability.
- Discuss potential impacts of dam management.
- Discuss potential for dam management to meet instream flow requirements.
- Propose dam management activity, schedule and estimate costs of Plan.

# Dam Management Plans

## Screening of Affected Dams:

- **Storage volume available for flow management.**
- **Size of contributing drainage area.**
- **Distance to Lamprey Designated River.**
- **Condition of existing dam to support flow management.**

# Dam Management Plans

## Screening of Affected Dams:

- Dams dropped from further consideration:
  - 8 of 11 state owned
  - 3 of 4 municipally owned
  - 4 of 5 privately owned
- Dams under consideration:
  - Mendums Pond Dam
  - Pawtuckaway Lake Dams (Dollof and Drowns)
  - Onway Lake Dam
  - Freezes Pond Dam

# Dam Management Plans

## Attributes of Selected Affected Dams

		Drainage	Impoundment	Maximum	Permanent	Delta	Distance	
		Area	Area	Storage	Storage	Storage	Upstream	Functional
Affected Dam	Dam ID #	(sq. mi.)	(acre)	(ac-ft)	(ac-ft)	(ac-ft)	(miles)	Outlet
Dollof Dam	184.02	21	900	4320	3564	756	14	Yes
Drowns Dam	184.04	21	900	4320	3564	756	10	Yes
Freeses Pond Dam	61.02	8.58	55.3	432	192	240	28	Yes
Mendums Pond Dam	184.01	6.97	265	3330	1960	1370	7	Yes
Nottingham Lake Dam*	184.08	14.6	41	266	172	94	3.5	Yes
Onway Lake Dam	201.01	8.45	192	881	305	576	19	Yes
Wiswall Dam*	71.04	183	30	500	360	140	On	Yes
Note:	Data from NHDAMS data sheets except for Nottingham Lake Dam data taken from application to reconstruct the dam.							
	* - not proposed for dam management, but operations must allow passage of relief flow.							

# Dam Management Plans

## Water Management Action:

- Store and release water from selected dams to provide two-day relief flow to maintain protected instream flow.
- Sufficient flow to be provided to raise flow levels on Lamprey Designated River above Rare flow limit for two days. Resets duration and flow.

# Dam Management Plans

## Relief Volumes to Maintain PISFs

			Common		Critical		Rare	
Bioperiod name	Bioperiod number	Two Day Volume in Ac-ft	Catastrophic	Persistent	Catastrophic	Persistent	Catastrophic	Persistent
R&G	1	65	48	15	99	99	99	99
Salmon	2	65	30	79	58	50	99	97
Overwintering	3	65	22	29	40	69	95	82
Spring Flood	4	65	6	10	28	28	89	74
Clupeid Spawning	5	65	94	62	51	89	69	94
GRAF Spawning	6	65	39	34	99	99	99	99
			Common		Critical		Rare	
Bioperiod name	Bioperiod number	Two Day Volume in Ac-ft	Catastrophic	Persistent	Catastrophic	Persistent	Catastrophic	Persistent
R&G	1	150	69	28	99	99	99	99
Salmon	2	150	65	88	99	99	99	99
Overwintering	3	150	48	32	89	79	99	99
Spring Flood	4	150	13	17	60	57	92	94
Clupeid Spawning	5	150	95	65	95	99	99	99
GRAF Spawning	6	150	57	50	99	99	99	99

# Dam Management Plan Concept

- Selected dams will operate impoundments to store water following DMP guidelines
- DES will identify management events
  - All catastrophic events (some will fail)
  - Third consecutive persistent event
- DMP will define a release procedure for each bioperiod event – always the same

# Volume to meet PISF needs based on 30-year period

Bioperiod name	Period	Acre-feet	Critical		Rare		cfs
			Catastrophic	Persistent	Catastrophic	Persistent	
Overwintering	Dec 9 – Feb 28	-	From retained water not released in fall				-
Spring Flood	Mar 1 – May 4	-	Not managed other than retaining Overwintering				-
Clupeid Spawning	May 5 – Jun 19	<b>150</b>	<b>95%</b>	<b>99%</b>	<b>99%</b>	<b>99%</b>	<b>38</b>
GRAF Spawning	Jun 20 – Jul 4	<b>28</b>	<b>99%</b>	<b>99%</b>	<b>99%</b>	<b>99%</b>	<b>7.1</b>
R&G	Jul 5 – Oct 6	<b>38</b>	<b>88%</b>	<b>87%</b>	<b>90%</b>	<b>99%</b>	<b>9.6</b>
Salmon	Oct 7 – Dec 8	<b>75</b>	<b>67 to 95%*</b>	<b>58 to 95%*</b>	<b>99%</b>	<b>99%</b>	<b>19</b>
	Sum	<b>291</b>	* Interpolation of graph for very rare occurrences				

# Water Use Plans

## Elements of Individual Plans:

- Define water use patterns and needs of the Affected Water User (AWU).
- Potential for water use modification, sharing or both to meet PISF.
- Coordination with Dam Management Plans to maintain protected instream flows.
- Develop implementation schedule and evaluate any costs.

# **Water Use Plans**

## **Affected Water Users and Affected Dam Owners Requiring Water Use Plans:**

- **Epping Water Works**
- **Newmarket Water Works**
- **Nottingham Lake Dam**
- **Raymond Water Department**
- **Scenic Nursery & Landscaping**
- **UNH/Durham Water System**

# Water Use Plans

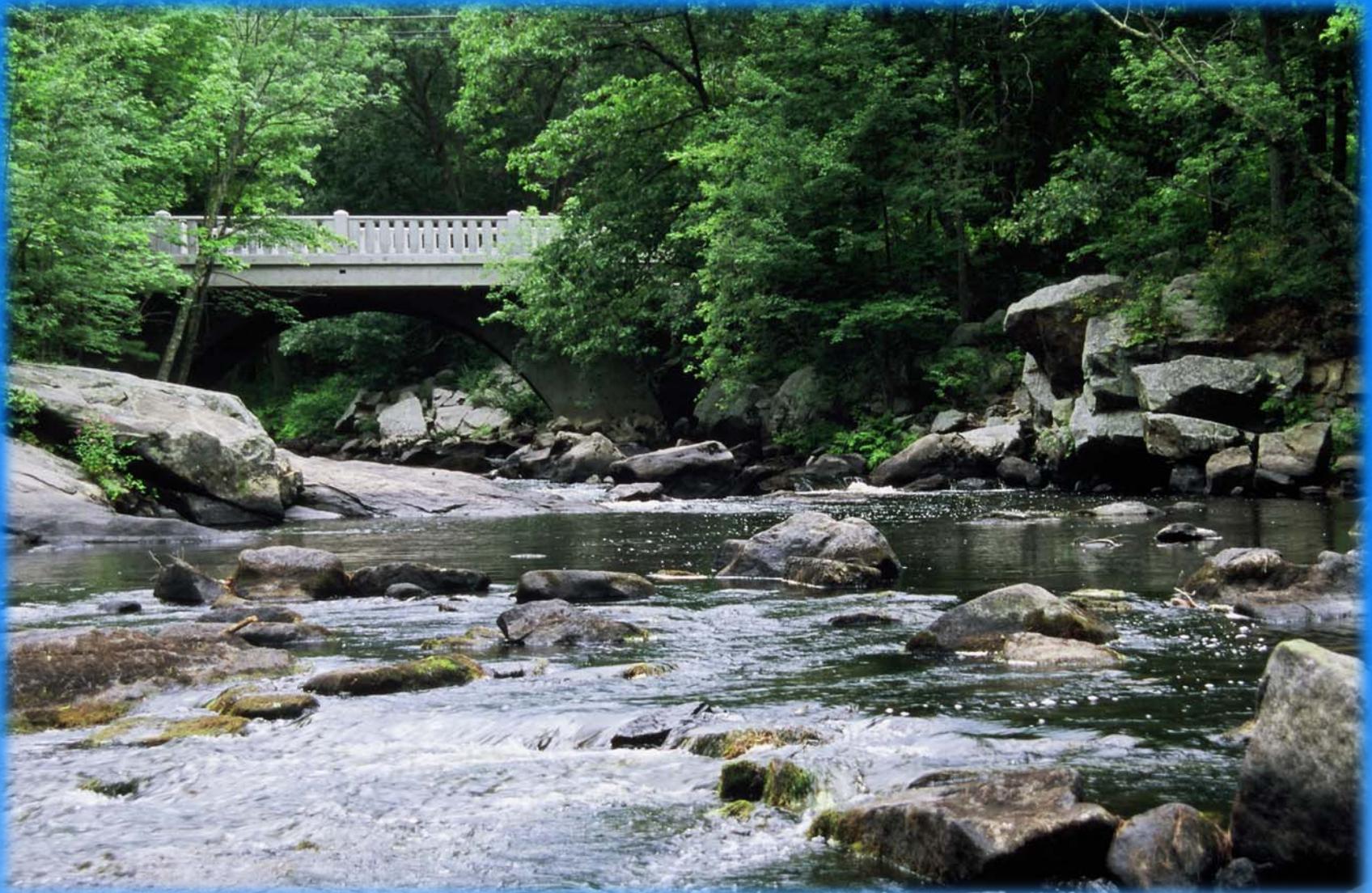
## Water Management Action:

- Focus on direct withdrawals and induced recharge sources first.
- Reduce and spread peak water usage when flows drop below Critical and Rare flow thresholds during summer /early fall bioperiods.
- Provide relief flows from dams to raise flow on Lamprey Designated River above Rare flow threshold.

# **The Water Management Plan**

- **Integrates information from individual Conservation, Water Use and Dam Management Plans.**
- **Specifies conservation and operational measures to be implemented by each Affected Water User and Affected Dam Owner to meet PISF requirements.**
- **Develops implementation schedule.**
- **Identify and evaluate financial assistance available to public water supply AWUs to meet plan.**

Comments or questions?



# Project Contacts

**Wayne Ives – Department of Environmental Services (DES):**

**Phone: 603-271-3548**

**email: [wayne.ives@des.nh.gov](mailto:wayne.ives@des.nh.gov)**

**Al Larson – Normandeau Associates, Inc.:**

**Phone: 603-472-5191**

**email: [alarson@normandeau.com](mailto:alarson@normandeau.com)**

