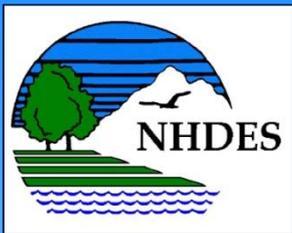


Lamprey River WMPAAC Meeting

February 11 2011



Lamprey River Water Management Plan

- Introduction
- Acceptance of meeting minutes
- Protected Instream Flow Tracking
- Water Management Plans
 - Conservation Plans
 - Dam Management Plans
 - Water Use Plans
- The Water Management Plan
- Moving Forward

Protected Instream Flow Tracking

- Tracking of flows by DES.
- Flow data posted on web site.
- Includes:
 - PISF table of conditions
 - Current & historical PISF graphs
 - Table of PISF values
 - Daily data – calculations and download

http://www2.des.state.nh.us/onestoppub/watershed/lamprey_pisf_tracking.xls

Current Protected Instream Flow Condition: Stream flow magnitude is not at a level of concern.

Protected flows are based on the habitat needs of fish. Fish life stages are adapted to the changing flows occurring over the seasons. The protected flows also change during the year to support biologically-significant life stages. The year has been divided to encompass these stages and the divisions are named "bioperiods." No flow management will be conducted during the Spring Flood bioperiod.

There are 20 days remaining in the current bioperiod as of February 9, 2011

	Bioperiod	Start	End
These are the Lamprey Protected Instream Flow Bioperiods.	Over-Wintering	9-Dec	28-Feb
	Spring Flood	1-Mar	4-May
	Shad Spawning	5-May	19-Jun
	GRAF Spawning	20-Jun	4-Jul
	Rearing & Growth	5-Jul	6-Oct
	Salmon spawning	7-Oct	8-Dec

As important as the time of the year when flows are needed are the magnitudes that support each life stage. Each bioperiod has three magnitudes that we use to evaluate whether streamflow conditions are meeting habitat needs. The Rare flows represent the threshold defining the highest levels of stress from low flows. The Critical flows represent warning levels that are approaching the Rare flows. The Common flows represent optimal habitat conditions that are necessary for fish species to recover from periods of stress. Management will only occur for the acute stress levels represented by the Rare and Critical flow magnitudes.

Stream flow on 02/07/2011	209	cfs - daily average value (cubic feet per second)	Recent stream flow magnitudes.
Stream flow on 02/08/2011	220	cfs - daily average value (cubic feet per second)	
Stream flow on 02/09/2011	225	cfs - daily average value (cubic feet per second)	
Protected Instream Flow Magnitudes	73	cfs - Rare Protected Instream Flow magnitude	Protected Instream Flow magnitudes.
	110	cfs - Critical Protected Instream Flow magnitude	
	238	cfs - Common Protected Instream Flow magnitude	

For current stream flow conditions see US Geological Survey's flow measurement data for USGS 01073500 LAMPREY RIVER NEAR NEWMARKET, NH http://waterdata.usgs.gov/nh/nwis/dv/?site_no=01073500&agency_cd=USGS&referred_module=sw

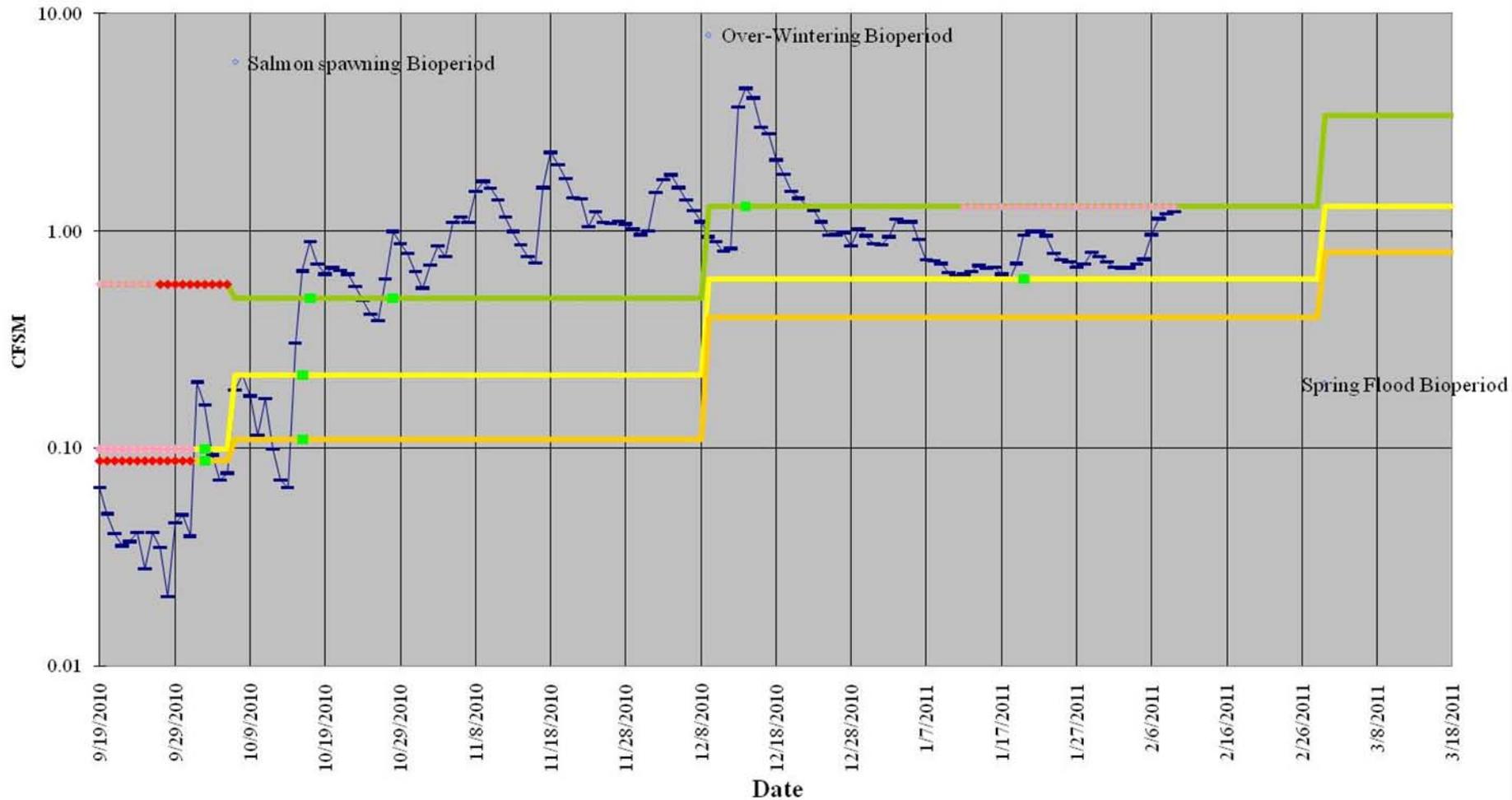
Streamflows vary dramatically and they commonly go below levels that support fish. Because fish are adapted to these stressful conditions, they can survive so long as these conditions don't last too long or occur too frequently. Therefore durations are defined and they are based on historical frequency analysis of the flow magnitudes.

Durations have been identified describing conditions that affect fish either as chronically stressful conditions that we call Persistent durations, or acute conditions that we call Catastrophic durations. Each bioperiod and each flow magnitude has a Persistent and a Catastrophic duration identified. Management is planned only for the Critical and Rare flow magnitudes and their durations.

As of 02/09/11

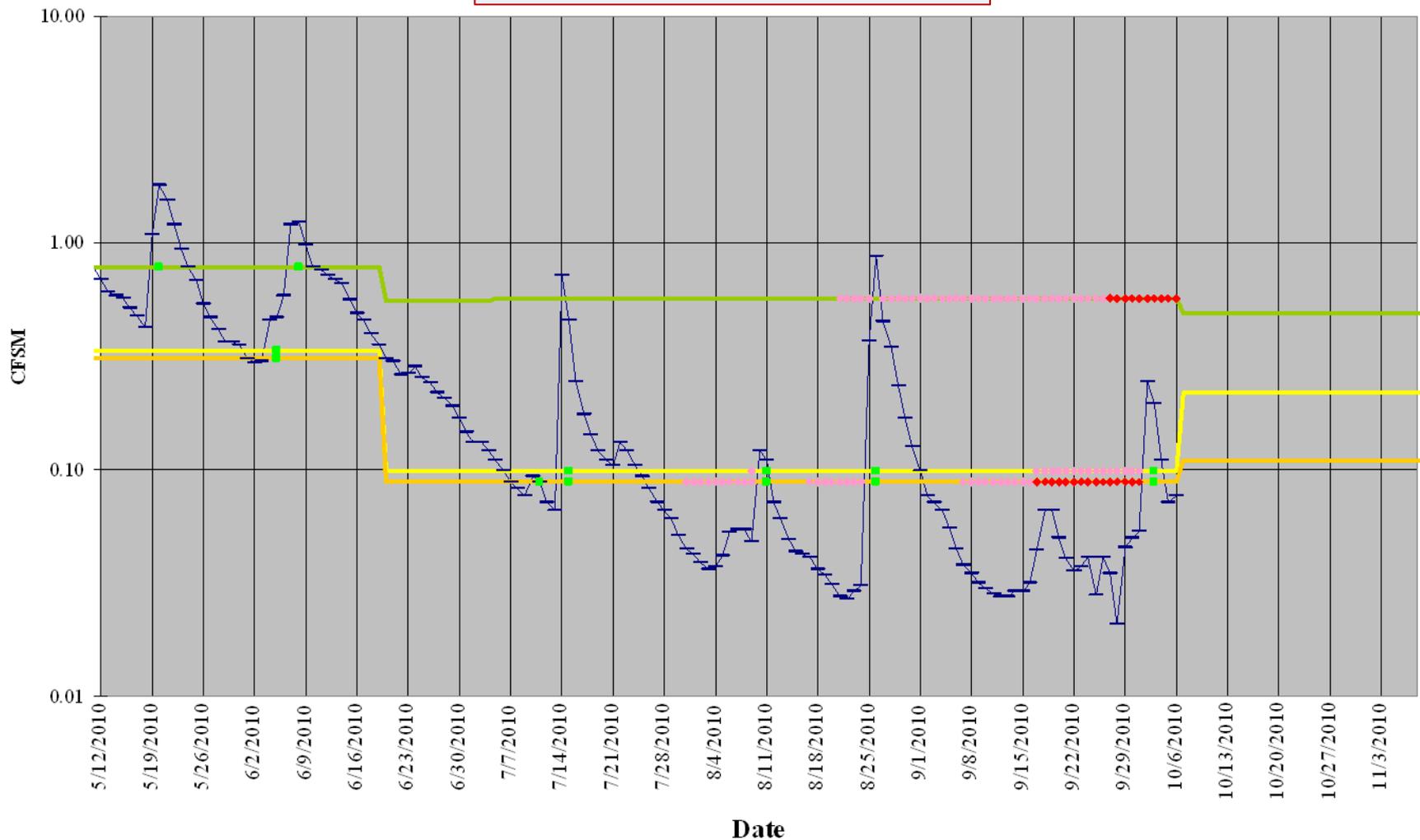
Durations relative to the Critical PISF Magnitude	Count of consecutive days with streamflow below CRITICAL PISF	Currently above
	CRITICAL Persistent duration (days)	10
	Days left until a CRITICAL Persistent condition may begin within (days)	> or = to 10
	CRITICAL Catastrophic condition duration (days)	37
	Days left until a CRITICAL Catastrophic condition may begin	> or = to 37
Durations relative to the Rare PISF Magnitude	Count of consecutive days with streamflow below RARE PISF	Currently above
	RARE Persistent PISF condition duration (days)	7
	A RARE Persistent condition may begin within (days)	> or = to 7
	RARE Catastrophic condition duration (days)	30
	Days left until a RARE Catastrophic condition may begin	> or = to 30

Lamprey PISF tracking



- | | | | |
|-------------------------------|------------------------------|-----------------------------|-----------------------------|
| — 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 | |

Summer of 2010



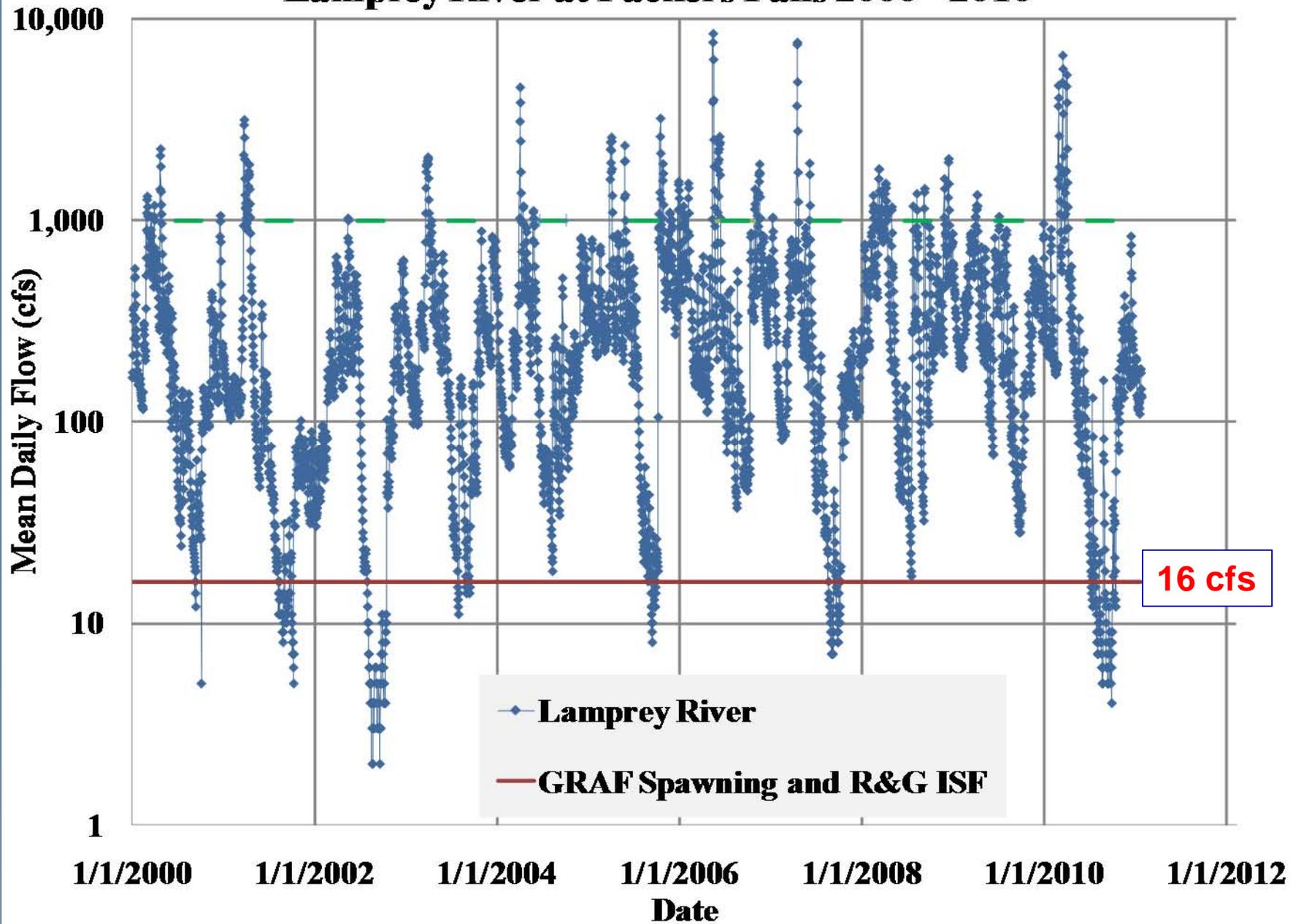
- | | | | |
|-------------------------------|-----------------------------|---------------------------|-----------------------------|
| — Stream flow (cfsm) | — Common protected flow | — Critical protected flow | — Rare protected flow |
| ◆ Common Persistent event | ◆ Critical Persistent event | ◆ Rare Persistent event | ◆ Common Catastrophic event |
| ◆ Critical Catastrophic event | ◆ Rare Catastrophic event | ■ Common Reset | ■ Critical Reset |
| ■ Rare Reset | | | |

Protected Instream Flow Tracking

Lamprey Flow Summer 2010 vs. PISF

- GRAF Spawning and Rearing and Growth Bioperiod (June 20 – October 6).
- Days that flow < 18 cfs, but > 16 cfs = 3
- Days that flow < 16 cfs = 34
- Flow < 16 cfs for greater than 15 days = 1 time: September 17 to October 2, 15 days.

Lamprey River at Packers Falls 2000 - 2010



Protected Instream Flow Tracking

Lamprey Flow 2000 – 2010 vs. PISF

- **GRAF Spawning and Rearing and Growth Bioperiod (June 20 – October 6).**
- **Number of times flow below Rare (16 cfs) for longer than Catastrophic duration (15 days):**
 - **None in 7 of 11 years (2000, 2003 to 2006, 2008 & 2009).**
 - **Once during: 2001 (8 days), 2002 (53 days), 2007 (5 days) and 2010 (15 days).**

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**

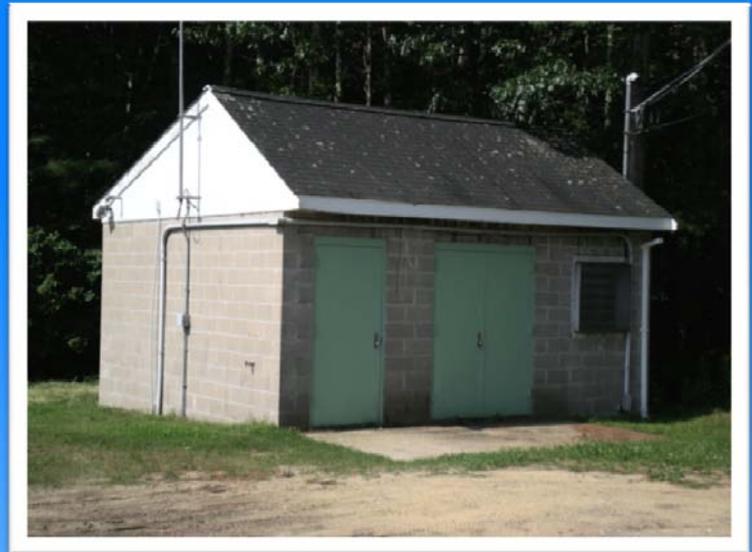
Water Management Plan

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)



North River Pond Dam

Water Management Plan

Affected State Owned Dams

- **Beaver Pond Dam - DRED (50 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 ac.)
- Hoar Pond Dam, Epping (26 ac.)
- Thurston Pond Dam, Deerfield (13.5 ac.)
- Wiswall Dam, Durham (30 ac.)



Freeses Pond Dam

Water Management Plan

Affected Privately Owned Dams

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



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

Water Management Plan

Affected Water Users

- **Epping Water Works - Public Water Supply**
- **Raymond Water Works - Public Water Supply**
- **Scenic Nursery & Landscaping - Agricultural**
- **University of New Hampshire/Town of Durham Water System (UDWS) - 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
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
Based on reported water use to 2008

Water Management Plan



Water Management Plan

Notable changes in sub-plans since last WMPAAC meeting (July 9):

- AWUs will get Water Conservation Plans through DES Drinking Water and Groundwater Bureau.**
- Outside water use plans for public water supplies shifted to the Water Use Plans.**
- Flow and duration values only re-set by naturally occurring flows exceeding protected instream flows for two days.**

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:

- **Outlined in Water Conservation Rules (Env-Wq 2100) Part Env-Wq 2101 Water Conservation and Part Env- Wq 2102 Water Use Registration and Reporting.**
- **Requirements are water use type specific; agricultural and public water suppliers or large community water systems.**

Conservation Plans

Basic Water Conservation Requirements for Agriculture:

- Measure volume of water used by source.
- Measurements must be accurate within 10%.
- Implement irrigation processes in accordance with “Irrigation: Best Management Practices for Agriculture in New Hampshire” by Department of Agriculture (March 1998).

Conservation Plans

Basic Water Conservation Requirements for Agriculture:

- **Schedule irrigations with appropriate amounts and frequency.**
- **Measure current soil water status, rainfall and irrigation water applied.**
- **Balance rainfall and irrigation applications with plant water use.**
- **Design and maintain irrigation systems to prevent waste and for most efficient use.**

Conservation Plans

Basic Water Conservation Requirements for Public Water Suppliers:

- 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 for Public Water Suppliers:

- 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

Water Management Action:

- **Submittal and approval of Water Conservation Plan to DES's Drinking Water and Groundwater Bureau.**
 - **Epping – Draft plan submitted 2008.**
 - **Raymond – Draft plan in progress.**
 - **Scenic Nursery – DES assisting.**
 - **UDWS – Draft plan submitted 2008.**
- **Implement final conservation plans by June 2012.**

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:
 - 7 of 10 state owned
 - 3 of 4 municipally owned
 - 4 of 5 privately owned
- Dams under consideration:
 - Mendums Pond and Pawtuckaway Lake dams
 - Contingency dams – Freezes Pond and Onway Lake dams

Dam Management Plans

Attributes of Selected Affected Dams

Affected Dam	Dam ID #	Drainage Area (sq. mi.)	Impoundment Area (acre)	Maximum Storage (ac-ft)	Permanent Storage (ac-ft)	Delta Storage (ac-ft)	Distance Upstream (miles)	Functional Outlet
Dollof Dam	184.02	21	900	4320	3564	756	14	Yes
Drowns Dam	184.04	21	900	4320	3564	756	10	Yes
Freezes 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

Relief Flow Concept:

- **Store and release water from selected dams to provide two-day relief flow to support 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 counter for flow tracking.**

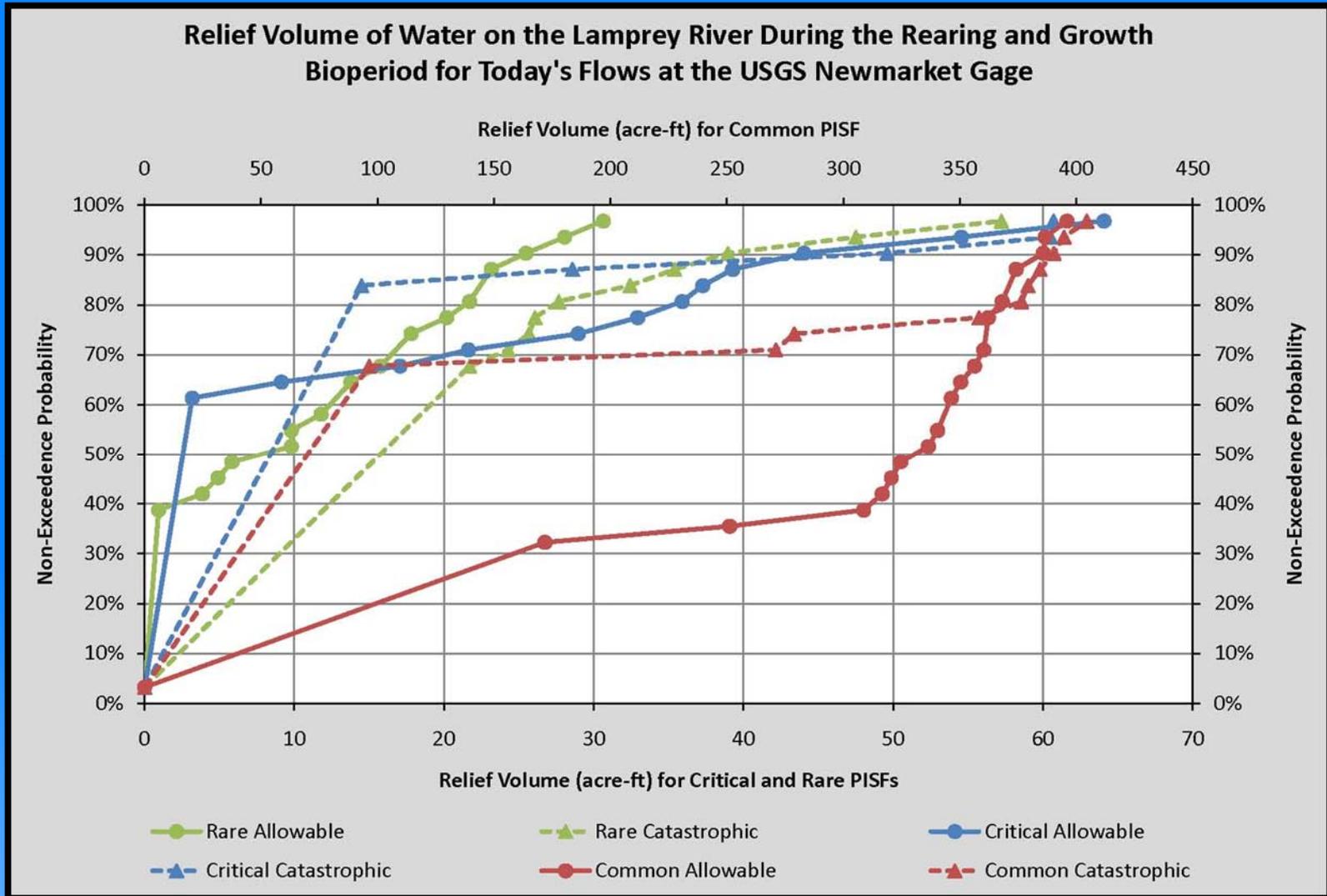
Dam Management Plans

Relief Flow Analysis:

- 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, then estimated for two day period.
- Volume of relief flows based on results of Task 8 analysis performed by UNH.
- Probability that volume of water sufficient to raise streamflow above PISF.

Dam Management Plans

Distribution of Two-Day Relief Flow Volumes



Dam Management Plans

Relief Volume to Maintain all 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 Plans

Water Management Action:

- Selected dams will operate impoundments to store water following DMP guidelines.
- DES will identify Critical and Rare management events:
 - All catastrophic events (some will fail)
 - Third consecutive persistent event
- DES will notify downstream dam owners of pending release to allow passage of relief flow.

Dam Management Plans

Water Management Action Relief Volumes

Bioperiod name	Period	Volume needed to meet 90% of historical deficits (ac-ft)	Volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)	Equivalent two-day flow release (cfs)	Change in water level from full pool using releases that meet 90% of historical deficits w/ 20% buffer (feet)	Water source
Overwintering	Dec 9 – Feb 28	216	259	65	0.33	Mendums Pond not used
Spring Flood	Mar 1 – May 4	-	-	-	-	No active management planned
Clupeid Spawning	May 5 – Jun 19	118	141.6	36	0.14	from storage and drawdown
GRAF Spawning	Jun 20 – Jul 4	20	24	6	0.02	from storage and drawdown
Rearing & Growth	Jul 5 – Oct 6	47	56.4	14	0.05	from storage and drawdown
Salmon Spawning	Oct 7 – Dec 8	75	90	23	0.09	from fall drawdown release
Sum of Clupeid to R&G		185	222	-	0.21	
Sum		476	571	-	0.63	

Change in water level is based on a starting point of full pool. Lower starting points will result in larger changes in water level.

Total water level change assumes that each of the bioperiods needs one relief flow during the year.

Assumes the end of the Spring Flood bioperiod's water level starts with a full recreational pool.

Mendums 265 Acres at full recreational pool

Pawtuckaway 783 Acres at full recreational pool

Dam Management Plans

Water Management Action Relief Volumes

Is 90th Percentile plus 20% enough?

- Goal is to prevent all but 1 event in 10 years (90% success rate).
- Selected the 90th percentile of 30 years of historical flow deficits.
- Added 20% as a buffer for unknown losses.
- Most deficits will be smaller than the worst-case (90%) event.

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

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 (June 20 to October 6).
- Provide relief flows from dams to raise flow on Lamprey Designated River above Rare flow threshold.

Water Use Plans

Scenic Nursery - Agricultural:

- Sources include shallow well, pond and temporary direct withdrawal from Lamprey River. Direct withdrawal 11% of total water use (average use 186,000 gal/yr or <0.001 cfs).
- Proposed management action – when flows fall below 16 cfs (Rare) for greater than 15 days (Catastrophic Duration) withdrawal from river limited to de minimis level (5% of 7Q10 – 0.25 cfs).

Water Use Plans

Epping and Raymond - PWS:

- Sources for both PWS are groundwater, not direct withdrawals from river.
- Epping - one bedrock well on tributary may induce infiltration, but use has declined to less than 10% of total supply.
- Raymond – three wells in stratified drift along river, may not induce infiltration, but do intercept potential recharge.

Water Use Plans

Epping and Raymond - PWS:

- Greatest system use occurs during summer/fall bioperiods that have lowest protected flows.
- Proposed management actions:
 - Voluntary **restriction** of outdoor water use at flows below 18 cfs (Critical).
 - Enforced **ban** of outdoor water use when flows fall below 16 cfs (Rare) for greater than 15 days (Catastrophic).

Water Use Plans

Epping and Raymond - PWS:

- **Outdoor water uses affected:**
 - watering of gardens and lawns
 - washing of cars, trucks, RVs, etc.
 - using water from a hose to rinse or clean property areas
 - using municipal water to fill swimming pools
- **Restrictions/bans lifted when naturally occurring flow on river is greater than PISF for two consecutive days.**

Water Use Plans

UDWS - PWS:

- Sources for UDWS include Lee Well, Oyster River and Lamprey River. Well and Oyster River outside Lamprey River watershed.
- Lamprey withdrawal from Wiswall Reservoir upstream of Wiswall Dam. Was emergency supply, now main supply source when flows on Lamprey > 45 cfs.
- Maximum capacity of withdrawal is 2.8 cfs (1,260 gpm or 1.8 mgd).

Water Use Plans

UDWS - PWS:

- **Greatest system use (due to increased UNH demand) occurs during late summer/fall bioperiods that have lowest protected flows.**
- **Proposed management actions:**
 - **Voluntary water conservation measures above normal practices when flow falls below 18 cfs (Critical) and when system demand is $\geq 75\%$ of max. available capacity. Stage 1 Alert + Stage 1 Actions.**

Water Use Plans

UDWS - PWS:

- Proposed management actions:
 - Mandatory water conservation measures (**restrictions** and **bans**) when flow is below 18 cfs for longer than 15 days and when system demand is $\geq 80\%$ of max. available capacity. Stage 2 Alert + Stage 2 Actions.
Restrictions – limited watering lawns + gardens (lawn watering odd/even days)
Bans - vehicle washing + filling pools

Water Use Plans

UDWS - PWS:

- Proposed management actions:
 - Mandatory water conservation measures (**restrictions** and **bans**) when flow is below 16 cfs for longer than 15 days and when system demand is $\geq 85\%$ of max. available capacity. Stage 3 Alert + Stage 3 Actions.
Restrictions – limited watering gardens
Bans - lawn watering, vehicle washing + filling pools

Water Use Plans

UDWS - PWS:

- Proposed management actions:
 - Mandatory outdoor water use **ban** when flow is below 16 cfs for longer than 25 days (catastrophic duration + 10 days) and when system demand is $\geq 85\%$ of max. available capacity. Stage 4 Alert + Stage 4 Actions.
- Restrictions/bans lifted when naturally occurring flow on river is greater than PISF for two consecutive days.

Water Use Plans

UDWS - PWS:

- **Proposed management actions:**
 - **Withdrawal from Lamprey limited to Wiswall Reservoir storage when flow falls flows fall below 16 cfs (Rare) for greater than 15 days (Catastrophic).**
 - **Maximum reservoir drawdown cannot exceed 18 inches below the Wiswall Dam spillway and maximum water level change cannot exceed one inch of drawdown per day. Inflow must equal outflow.**

Water Use Plans

UDWS - PWS:

- Proposed management actions:
 - De minimis volume (5% of 7Q10 – 0.25 cfs) always available for withdrawal.

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, if necessary.**

Moving Forward

- **Notice of public hearing (30 days) along with the release of draft Water Management Plan for public review.**
- **Public hearing to be held in Durham or Lee.**
- **Public comment period (30 days)**
- **Review and revise draft plan.**
- **Adoption of Water Management Plans (60 days).**
- **Legislative review of pilot project.**

Comments or questions?



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