

DRBC RFAC Meeting

June 17, 2009

THPDMP Effectiveness

- Current FFMP and THPDMP are working effectively
- Adaptively managed by the Decree Parties
- Good cooperation in program management between staff of NYC DEP, NYS DEC and DRM Office
- Heat wave of June 2008: much above normal temps, >90 F; very seldom it is that hot in June – an anomaly :
 - water temps fared well in tailwaters
 - water temps in E. Br. Del. R at Hancock at ambient air temps (>82) resulted in higher water temps in Del. R at Lordville
 - water temps d/s of Junction Pool dependent on flow in E. Br. Del R
 - occasional thermal stress conditions unavoidable in Del. R at Lordville and downstream if E. Br. flows exceed W. Br. Flows
- Spill in 5/09 : Spill transferred to releases during May 21 - 22

Temporary Thermal Releases Program for Fishery Protection (June 9-11, 2008)

- Unseasonably high air temps in early June 2008
- Rapid and large increases in water temps
- Decree parties approved NY request to implement a temporary program of emergency releases from Cannonsville

Temporary Thermal Releases Program for Fishery Protection (June 9-11, 2008)

(continued)

- To allow for emergency releases from Cannonsville Reservoir, subject to specific air temperature based triggering criteria
- To provide thermal protection in Del. R. downstream to Hancock, NY
- IERQ provided the water required for the program

EMERGENCY THERMAL RELEASES PROGRAM

(July 11 – September 15, 2008)

- Created to respond to potential future extraordinary thermal conditions on a timely basis (essentially continuation of June 9-11, 2008 Temporary Thermal Releases Program)
- A temporary program of emergency releases from Cannonsville Reservoir to provide thermal protection downstream to just below Hancock, NY

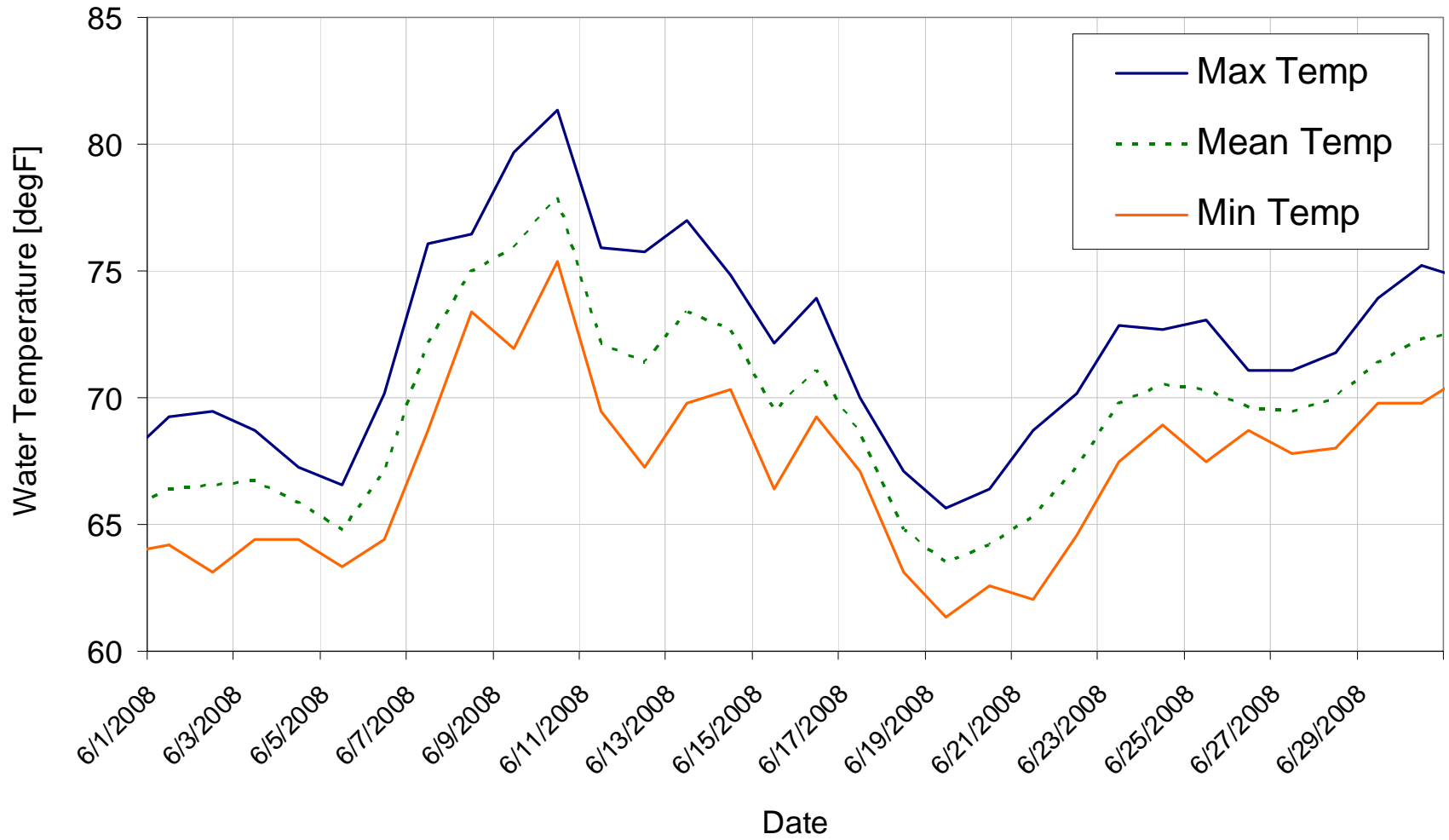
EMERGENCY THERMAL RELEASES PROGRAM

(July 11 – September 15, 2008)

(continued)

- An Extraordinary Needs Bank of 1,340 cfs-days created from the 2008-09 IERQ
- Montague target reduced from 1850 cfs to 1830 cfs to provide the water needed
- Triggering Criteria :
 - 3-day avg. max. air temp > 90 F
 - 3-day avg. min. air temp > 65 F(NWS Forecast for hancock, NY vicinity)
- Bank was not used in view of the selected severe criteria

Mainstem Delaware R. at Lordville, NY
June 2008 - Unseasonably warm air temperatures



Mainstem Delaware R. at Lordville, NY

Days with maximum temperature in excess of 75°F

	1989	1990	1991	1992	1993	1994	1995	1996	2006	2007	2008
1-Jun	70		74	57	60	72	73			77	69
2-Jun	73		73	61	63	68	73			74	69
3-Jun	73		71	64	66	67	75			73	69
4-Jun	70		69	66	68	70	75			66	67
5-Jun	68		65	65	64	68	74			70	67
6-Jun	66		68	61	58	66	75			67	70
7-Jun	62		70	65	61	71	76			69	76
8-Jun	63		68	67	67	68	75			73	76
9-Jun	64		68	68	71	70	73			73	80
10-Jun	66		69	69	72	74	71			73	81
11-Jun	67		67	70	71	73	65			74	76
12-Jun	69		64	71	74	63	64			73	76
13-Jun	68		61	73	74	70	64			73	77
14-Jun	63		64	73	77	71	67			72	75
15-Jun	58		63	74	74	73	68			70	72
16-Jun	58		69	72	67	75	68			68	74
17-Jun	63		67	73	72	75	72			69	70
18-Jun	62		63	71	72	78	74			74	67
19-Jun	65		65	67	68	79	77			73	66
20-Jun	67		68	65	65	77	79			71	66
21-Jun	67		66	63	67	73	77			68	69
22-Jun	69		64	59	70	72	73			68	70
23-Jun	70		62	62	70	73	65			68	73
24-Jun	67		65	63	72	71	69			69	73
25-Jun	67		63	63	71	66	67			72	73
26-Jun	69		65	66	67	72	64			73	71
27-Jun			64	68	65	70	68			73	71
28-Jun	69		64	71	67	68	71				72
29-Jun			66	73	70	69	71			69	74
30-Jun	69		65	75	72	69	67			70	75

	1989	1990	1991	1992	1993	1994	1995	1996	2006	2007	2008	
1-Jul				64	76	71	70	66			69	75
2-Jul				62	73	68	72	64			64	76
3-Jul	74	74	54	69	61	73	64				66	73
4-Jul	73	77	56	62	68	75	63				64	71
5-Jul		77	56	65	69	73	64				66	67
6-Jul		73	61	69	75	76	65				72	70
7-Jul	72	70	62	70	76	79	64				73	77
8-Jul	72	67		69	76	77	63				74	78
9-Jul	73	67		72	78	79	61				77	76
10-Jul	72		62	74	77	75	65				77	76
11-Jul	75	71	60	73	74	75	65				74	74
12-Jul	72	65	61	70	72	75	70				70	68
13-Jul	70	64	60	71	76	78	76				72	66
14-Jul	72	65	62	74	75	75	80				72	73
15-Jul	72	69	63	73	73	73	77				70	75
16-Jul	70	71	63	69	70	70	78				72	77
17-Jul	70	73	65	69	61	71	76				73	77
18-Jul	74	75	66	70	65	71	73				73	79
19-Jul	75	73	65	74	65	74	73				69	73
20-Jul	73	72	65	75	68	75	73				69	69
21-Jul	66	72	66	73	71	73	72				72	75
22-Jul	69	74	72	71	68	77	72				70	74
23-Jul	75	73		69	64	74	70				68	72
24-Jul	78			64	60	72	73				68	66
25-Jul	79			68	62	73	75				73	67
26-Jul	78	77		67	62	72	75				76	69
27-Jul	74	76	63	69	60	71	75				74	70
28-Jul	73	73	69	68	63	70	75				74	69
29-Jul	70	74	67	68	65	70	79				73	75
30-Jul	66	76	64	70	64	73	79				75	75
31-Jul	68	73	64	68	59	73	78				76	74

Flexible Flow Management Program (FFMP 2007)

- Implemented by the Decree Parties in October 2007

FFMP 2007 Objectives

(effective October 1, 2007)

- Montague Flow
 - 6/15 – 9/15 : 1850 cfs (normal conditions)
 - 9/14 – 6/14 : 1750 cfs (normal conditions)
- Trenton Flow : Per Section 2.5.3 of DRBC Water Code
- NYC Diversion : 765 mgd (normal conditions)
- NJ Diversion : 100 mgd (normal conditions)
- Releases : Per THPDMP (Table 3)
- Interim Excess Release Quantity
 - 15,468 cfs-days
 - 17,125 cfs-days during leap year

Figure 1
New York City Delaware System Usable Combined Storage
(Cannonsville, Pepacton and Neversink Reservoirs)

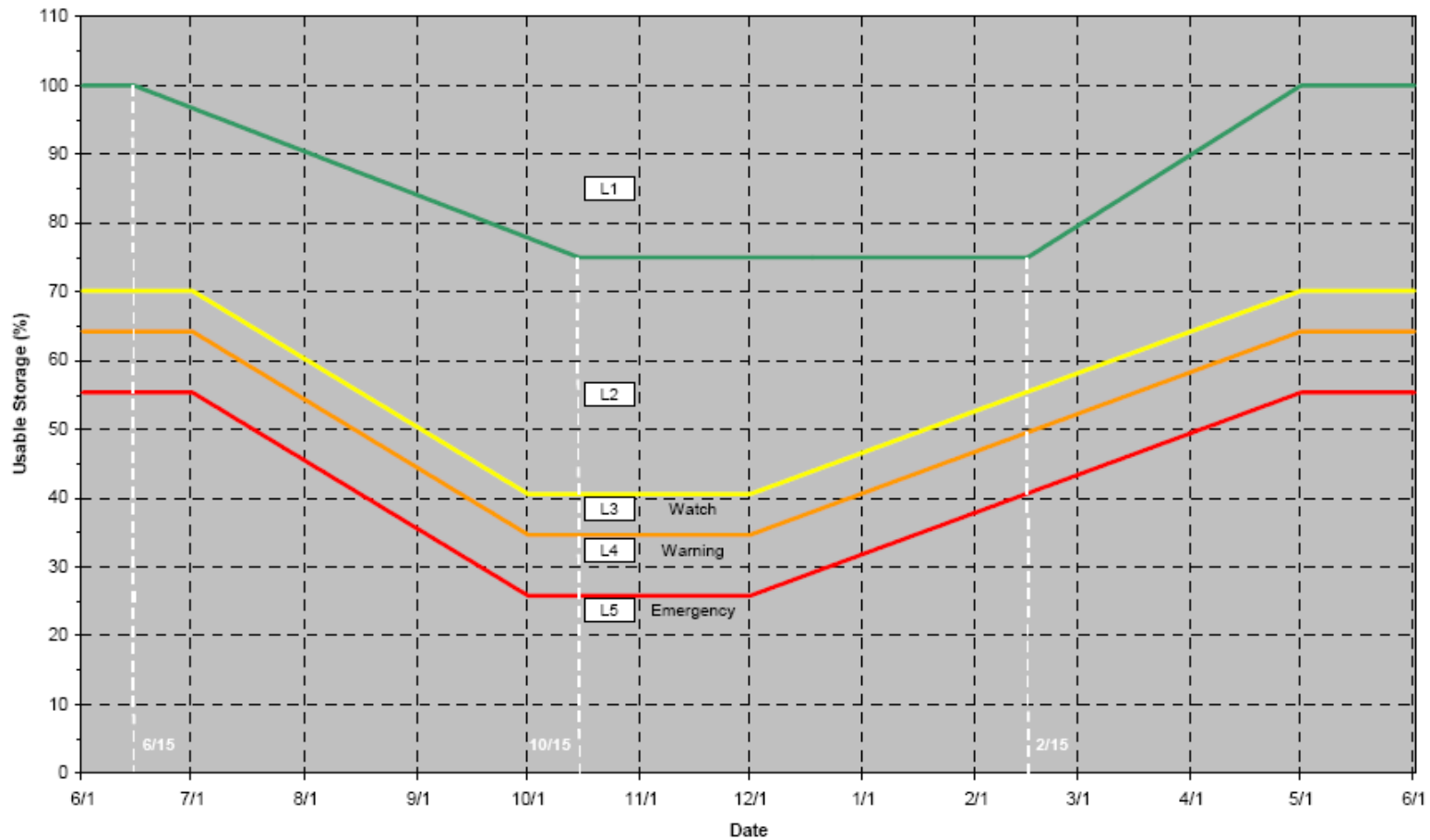
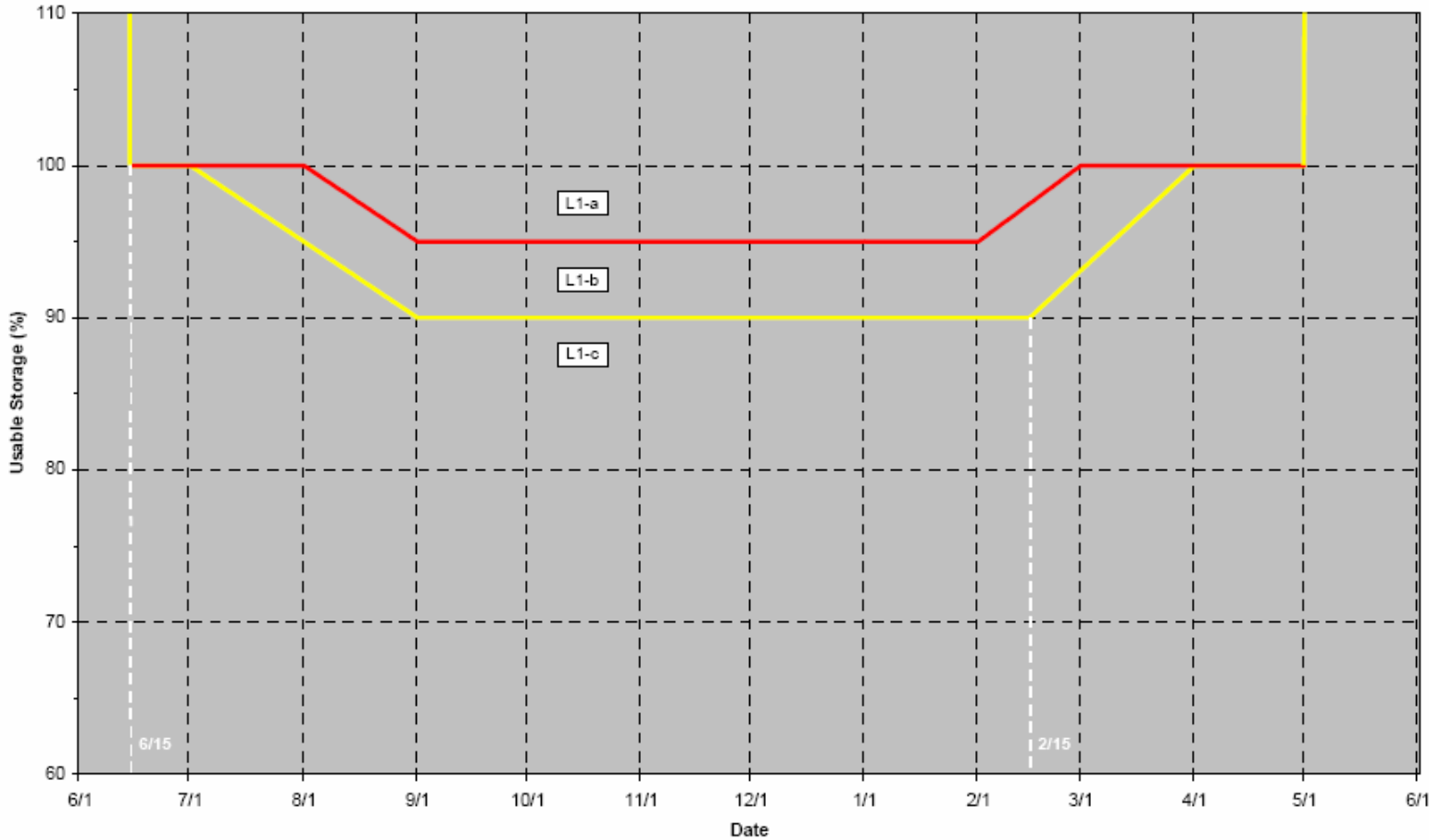


Figure 2
New York City Delaware System Usable Individual Storage
(Cannonsville, Pepacton and Neversink Reservoirs)



FFMP 2007

THPDMP Release Table (with 35 mgd available)

Table 3
Schedule Of Releases (cfs)
With 35 mgd Available

Cannonsville Storage Zone	Winter		Spring	Summer			Fall	
	Dec 1 - Mar 31	Apr 1 - Apr 30	May 1 - May 31	Jun 1 - Jun 15	Jun 16 - Jun 30	Jul 1 - Aug 31	Sep 1 - Sep 30	Oct 1 - Nov 30
L1-a	1500	1500	*	*	1500	1500	1500	1500
L1-b	250	*	*	*	*	350	275	250
L1-c	110	110	225	275	275	275	140	110
L2	80	80	215	260	260	260	115	80
L3	70	70	100	175	175	175	95	70
L4	55	55	75	130	130	130	55	60
L5	50	50	50	120	120	120	50	50

Pepacton Storage Zone	Winter		Spring	Summer			Fall	
	Dec 1 - Mar 31	Apr 1 - Apr 30	May 1 - May 31	Jun 1 - Jun 15	Jun 16 - Jun 30	Jul 1 - Aug 31	Sep 1 - Sep 30	Oct 1 - Nov 30
L1-a	700	700	*	*	700	700	700	700
L1-b	185	*	*	*	*	250	200	185
L1-c	85	85	120	150	150	150	100	85
L2	65	65	110	140	140	140	85	60
L3	55	55	80	100	100	100	55	55
L4	45	45	50	85	85	85	40	40
L5	40	40	40	80	80	80	30	30

Neversink Storage Zone	Winter		Spring	Summer			Fall	
	Dec 1 - Mar 31	Apr 1 - Apr 30	May 1 - May 31	Jun 1 - Jun 15	Jun 16 - Jun 30	Jul 1 - Aug 31	Sep 1 - Sep 30	Oct 1 - Nov 30
L1-a	190	190	*	*	190	190	190	190
L1-b	100	*	*	*	*	125	85	95
L1-c	65	65	90	110	110	110	75	60
L2	45	45	85	100	100	100	70	45
L3	40	40	50	75	75	75	40	40
L4	35	35	40	60	60	60	30	30
L5	30	30	30	55	55	55	25	25

* Storage zone does not apply during this period. Releases will be made in accordance with zone L1-c.

Flexible Flow Management Program Modification 1 (FFMP 2008)

- Implemented by the Decree Parties in December 2008

FFMP 2008

(effective December 10, 2008)

- Summer season in the FFMP 2007 :
June 1 – August 31
- In response to public requests, summer season was extended to include Memorial Day and Labor Day weekends in the FFMP 2008 :
May 21 – September 15

FFMP 2008 “Extended Season”

THPDMP Release Table

(with 35 mgd available)

Table 3
Schedule Of Releases (cfs)
With 35 mgd Available

Cannonsville Storage Zone	Winter		Spring		Jun 1 - 15-Jun	Summer		Sep 1 - 15-Sep	Fall	
	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May		Jun 16 - 30-Jun	Jul 1 - 31-Aug		Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	250	*	*	*	*	*	350	300	275	250
L1-c	110	110	200	250	275	275	275	275	140	110
L2	80	80	190	240	260	260	260	260	115	80
L3	70	70	100	100	175	175	175	95	95	70
L4	55	55	75	75	130	130	130	55	55	60
L5	50	50	50	50	120	120	120	50	50	50

Pepacton Storage Zone	Winter		Spring		Jun 1 - 15-Jun	Summer		Sep 1 - 15-Sep	Fall	
	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May		Jun 16 - 30-Jun	Jul 1 - 31-Aug		Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	185	*	*	*	*	*	250	200	200	185
L1-c	85	85	110	130	150	150	150	150	100	85
L2	65	65	100	125	140	140	140	140	85	60
L3	55	55	80	80	100	100	100	55	55	55
L4	45	45	50	50	85	85	85	40	40	40
L5	40	40	40	40	80	80	80	30	30	30

Neversink Storage Zone	Winter		Spring		Jun 1 - 15-Jun	Summer		Sep 1 - 15-Sep	Fall	
	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May		Jun 16 - 30-Jun	Jul 1 - 31-Aug		Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	100	*	*	*	*	*	125	125	85	95
L1-c	65	65	85	100	110	110	110	110	75	60
L2	45	45	75	90	100	100	100	100	70	45
L3	40	40	50	50	75	75	75	40	40	40
L4	35	35	40	40	60	60	60	30	30	30
L5	30	30	30	30	55	55	55	25	25	25

* Storage zone does not apply during this period. Releases will be made in accordance with zone L1-c.

**SUMMER 2009
RESERVOIR RELEASES
PROGRAM**

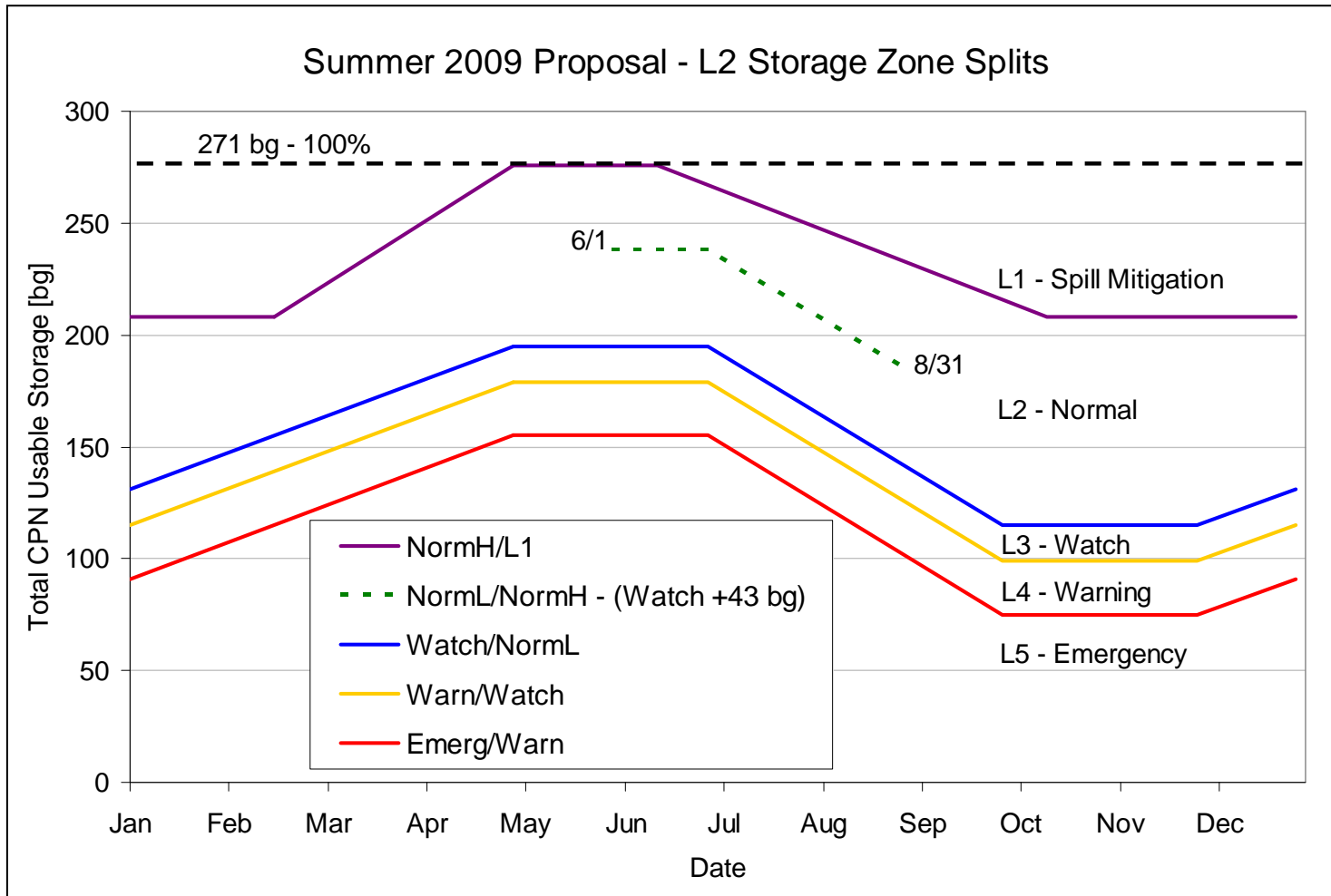
CURRENT PROPOSAL

- Fisheries staff of NY and PA supported the proposal
- Implemented by an agreement of the Decree Parties effective June 1, 2009
- More expansive proposal to improve summer habitat releases from Cannonsville Reservoir in an effort to mitigate in-stream thermal concerns
- Enhanced summertime Montague flow objective of 1850 cfs eliminated; Montague flow objective remains at 1750 cfs year-round
- 9300 cfs-days devoted for enhanced Montague objective held IERQ Extraordinary Needs Bank (IERQ ENB or BANK)

CURRENT PROPOSAL

- 6045 cfs-days of this bank used to enhance Cannonsville releases during summer (6/1 – 8/31) in storage zone L2
- 3255 cfs-days retained in the IERQ ENB for other purposes per FFMP
- Storage Rule Curve revised to divide L2 storage zone during 6/1 – 8/31
- Proposal will increase normal summer releases at Cannonsville Reservoir from 260 to 325 cfs
- Proposal release rates should significantly reduce temp concerns expressed by fishermen

Division of Summer L2 zone High and Low regions



The L2 division line is set 43 bg above the Watch line and is effective June 1st to August 31st only.

CURRENT PROPOSAL THPDMP Release Table

Cannonsville Storage Zone	Winter		Spring		Summer			Fall		
	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	250	*	*	*	*	*	350	275	275	250
L1-c	110	110	200	250	325/275	325/275	325/275	275	140	110
L2-High	80	80	190	240	325/260	325/260	325/260	260	115	80
L2-Low	80	80	190	240	300/260	300/260	300/260	260	115	80
L3	70	70	100	100	175	175	175	95	95	70
L4	55	55	75	75	130	130	130	55	55	60
L5	50	50	50	50	120	120	120	50	50	50

Pepacton Storage Zone	Winter		Spring		Summer			Fall		
	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	185	*	*	*	*	*	250	200	200	185
L1-c	85	85	110	130	150	150	150	150	100	85
L2-H/L	65	65	100	125	140	140	140	140	85	60
L3	55	55	80	80	100	100	100	55	55	55
L4	45	45	50	50	85	85	85	40	40	40
L5	40	40	40	40	80	80	80	30	30	30

Neversink Storage Zone	Winter		Spring		Summer			Fall		
	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	100	*	*	*	*	*	125	125	85	95
L1-c	65	65	85	100	110	110	110	110	75	60
L2-H/L	45	45	75	90	100	100	100	100	70	45
L3	40	40	50	50	75	75	75	40	40	40
L4	35	35	40	40	60	60	60	30	30	30
L5	30	30	30	30	55	55	55	25	25	25

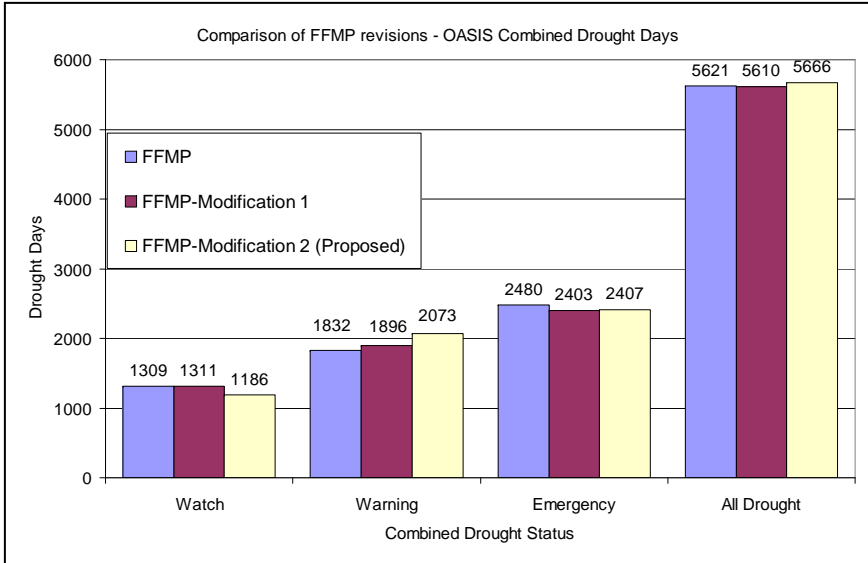
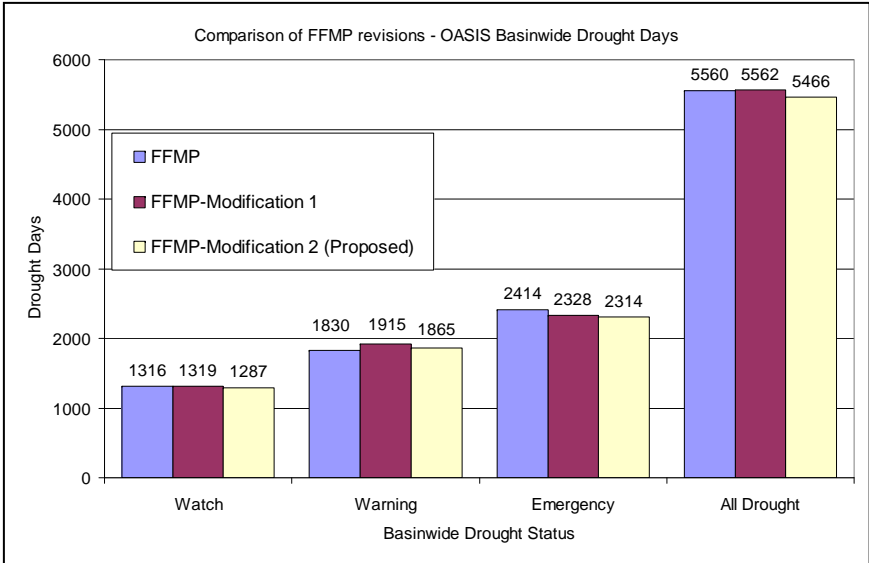
Cannonsville releases increased during 6/1 – 8/31

Benefits of Current Proposal

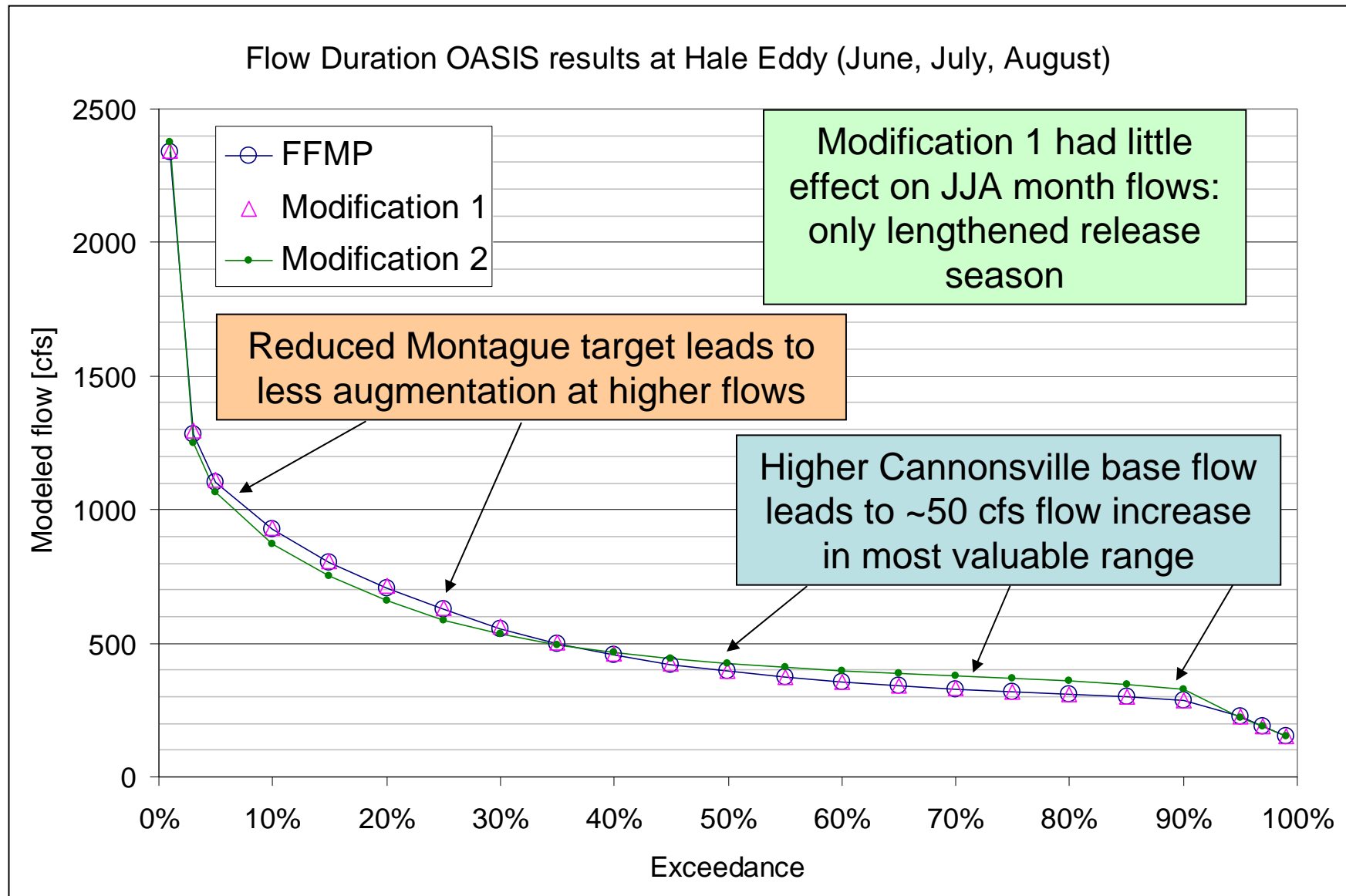
- Improved habitat with incremental Cannonsville releases in W. Br. Del. R. and in Upper Del. R to Hankins
- Temperature Mitigation in Upper Delaware River (in the vicinity of Junction Pool)
 - 25% more base flow water will extend coldwater plume below Hancock
 - Temperature Mitigation at Lordville, NY when flows in the East Branch are lower than in the West Branch
 - Thermal events still a possibility (when air temps are above normal for an extended period of time or when flows in the East Branch are higher than flows in the West Branch)
- Mitigation of “yo-yo-ing”
 - Reduced Montague target and higher Cannonsville base flow moves endpoints of ODRM release range closer together
 - A more efficient ramping procedure or modified Montague target would be beneficial and should remain a topic of investigation

Drought Days Chart

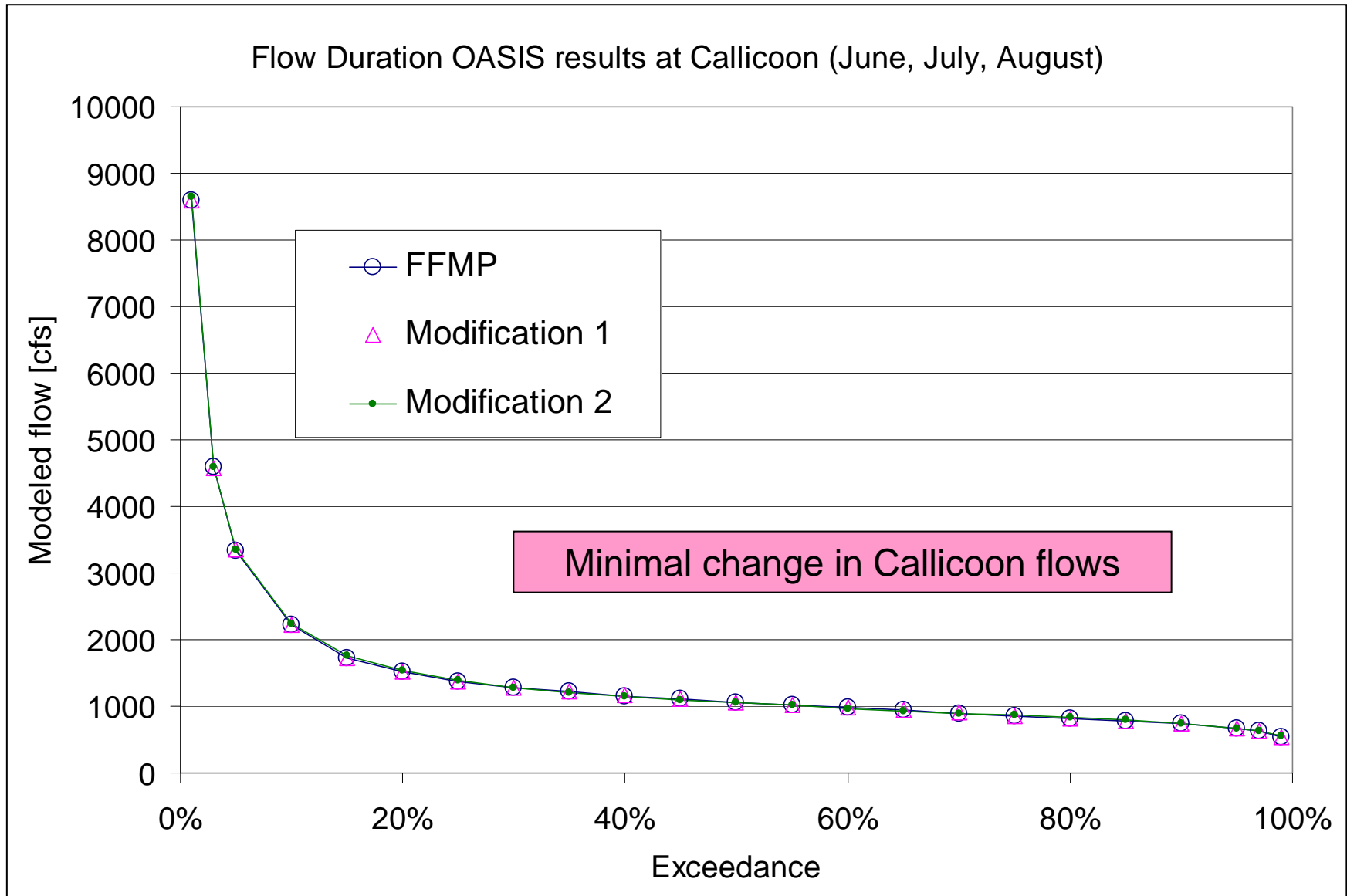
FFMP, Modification 1, Modification 2



Increased flows for habitat improvement at Hale Eddy

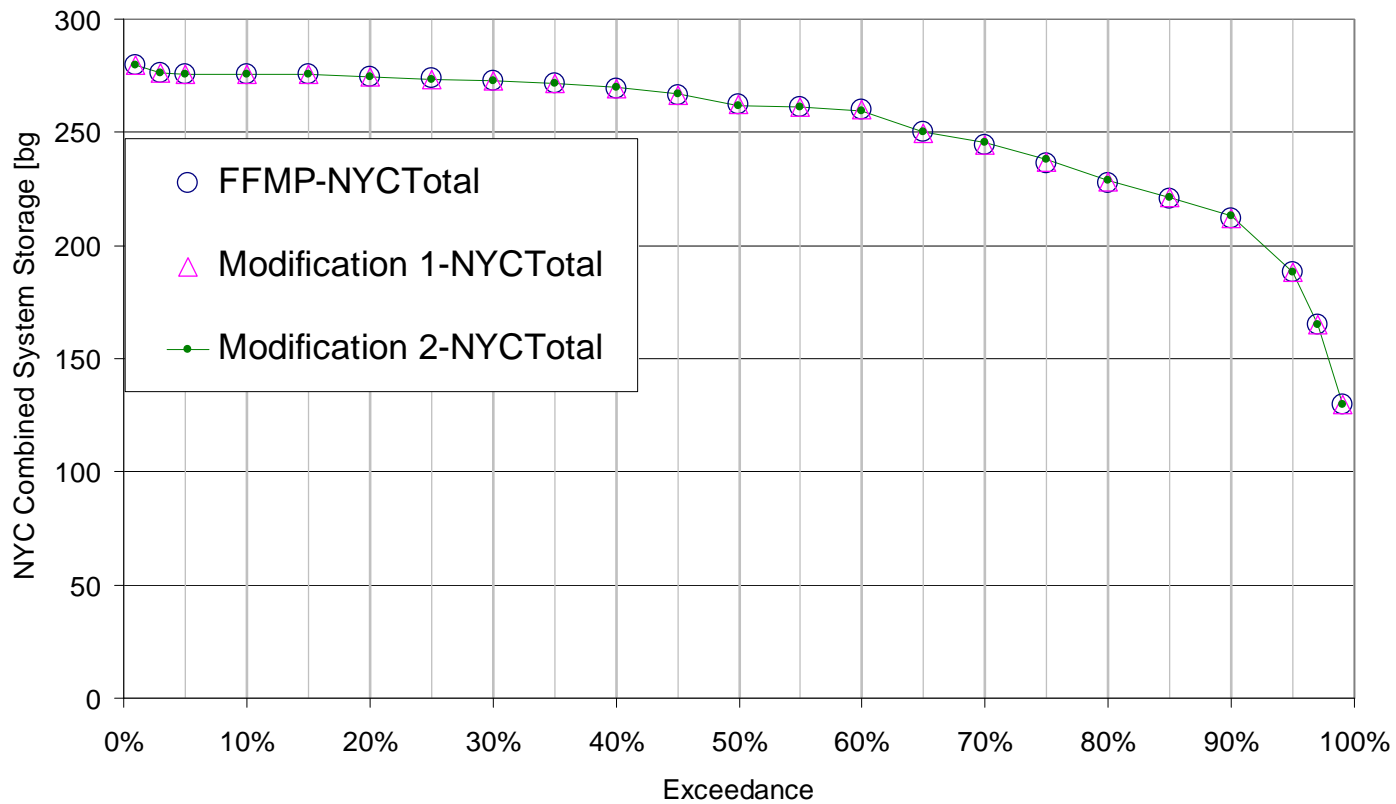


Flows at Callicoon

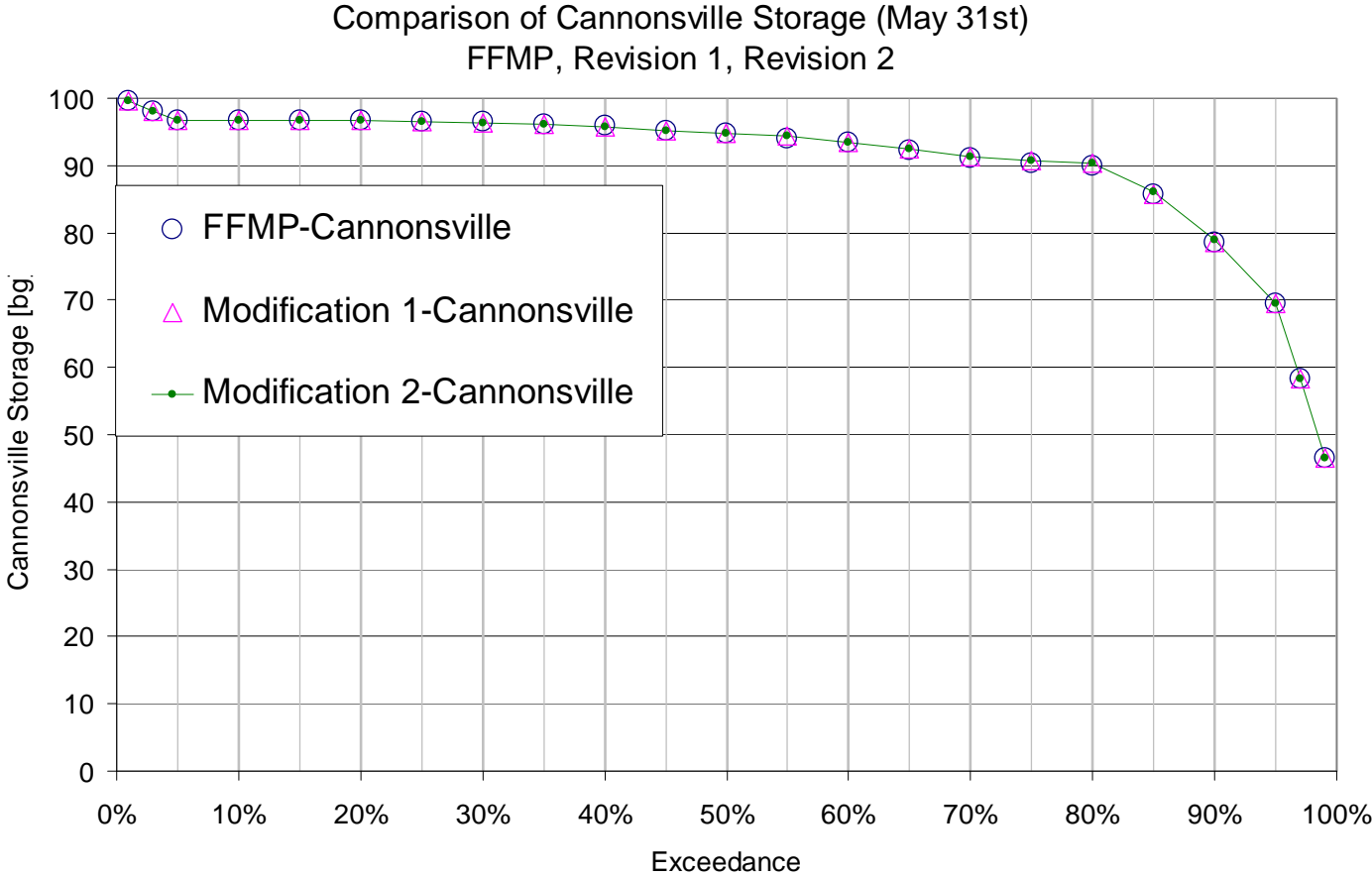


Delaware System Storage

Comparison of NYC System Storage (May 31st)
FFMP, Revision 1, Revision 2



Cannonsville Reservoir Storage



CONCERN !!

- Yo-yo-ing : an issue of great concern to fishing constituency; it causes disruption to fish and damage macroinvertebrates when rapid decrease in flows exposes gravel bars
 - an effect of large day-to-day and sub-daily changes in streamflows caused by rapid changes in release rates (PPL operations, weather forecast errors etc. need to be addressed – Montague averaging ? gradual ramping ? Releases to match runoff?)
 - an effect of storage zone changes resulting in steep changes in releases during 4/09 (this problem corrected by DPWG by changes in FFMP language)