

Presented to the DRBC Regulated Flow Advisory Committee on September 28, 2017. Contents should not be published or re-posted in whole or in part without the permission of DRBC.

# Delaware River Basin Commission

## FFMP Implementation Performance

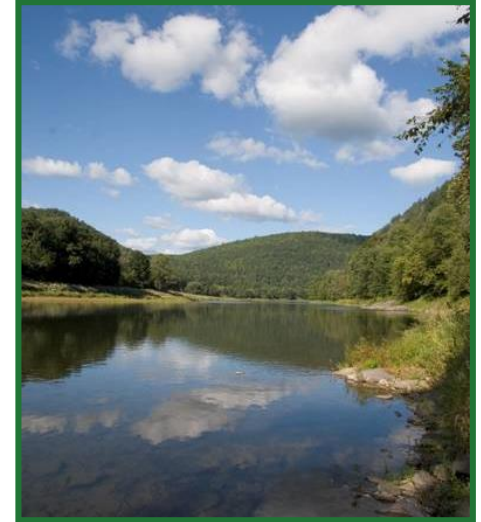
Release Year 2016

June 1, 2016 – May 31, 2017

***Amy L. Shallcross, PE***

Manager, Water Resource  
Operations

*July 2017*



**Delaware River Basin Commission**

DELAWARE • NEW JERSEY  
PENNSYLVANIA • NEW YORK  
UNITED STATES OF AMERICA

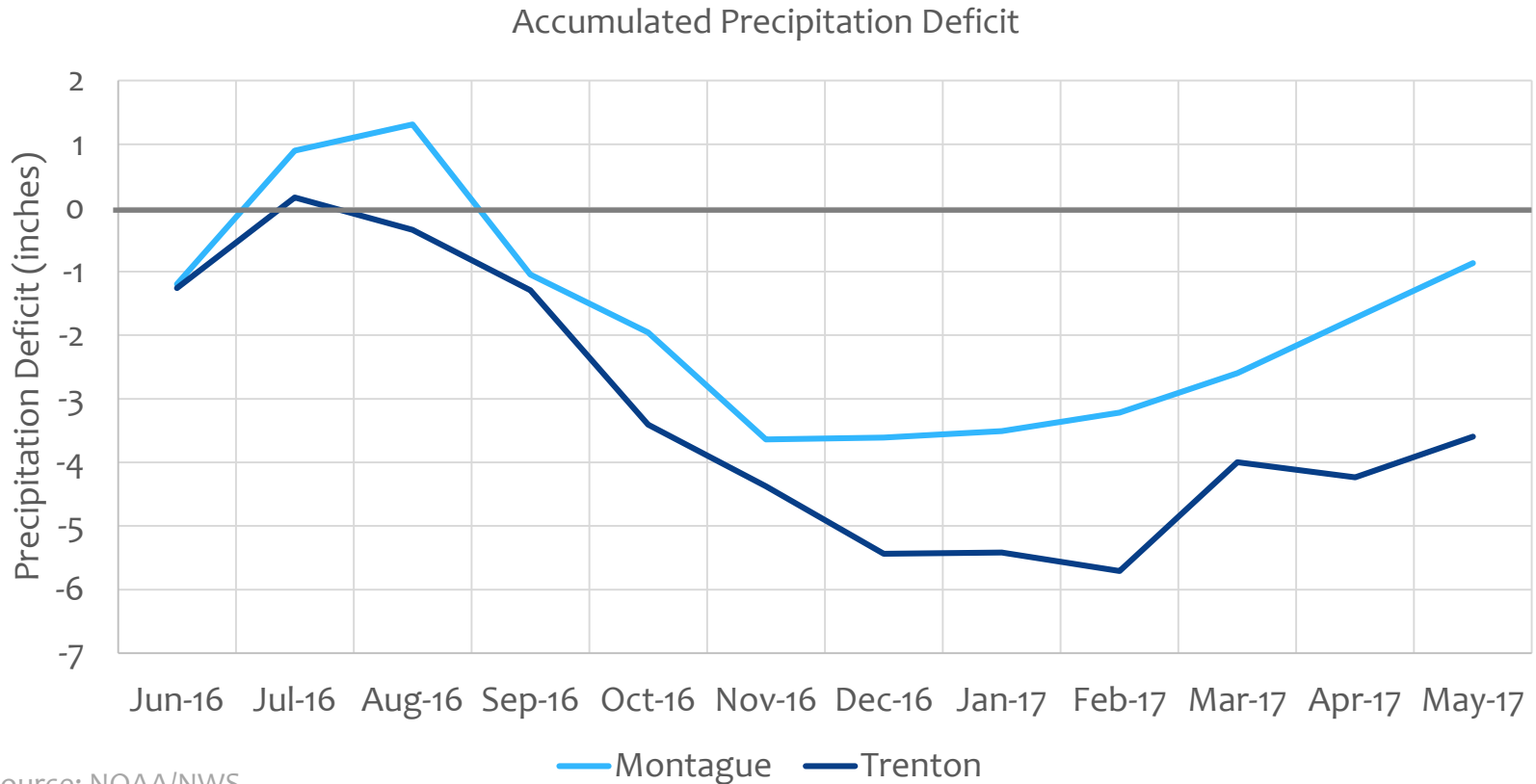
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# FFMP Performance Goals

- \* Manage droughts
- \* Maintain flow objectives
- \* Provide enhanced conservation releases
- \* Maintain desirable tailwater temperatures
- \* Minimize spills using the Conditional Seasonal Storage Objective (CSSO)

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# Precipitation Deficit



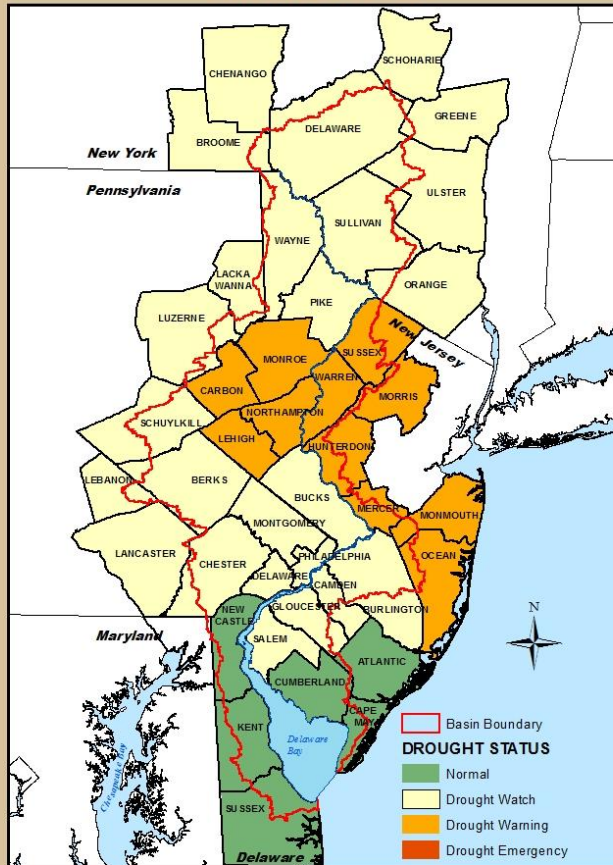
Data Source: NOAA/NWS

Except for the summer, the basin experienced a precipitation deficit for most of the 2016-2017 release season.

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# Drought Conditions

**Drought Status in the Delaware River Basin  
as Declared by the Basin States  
Effective 11/3/2016**

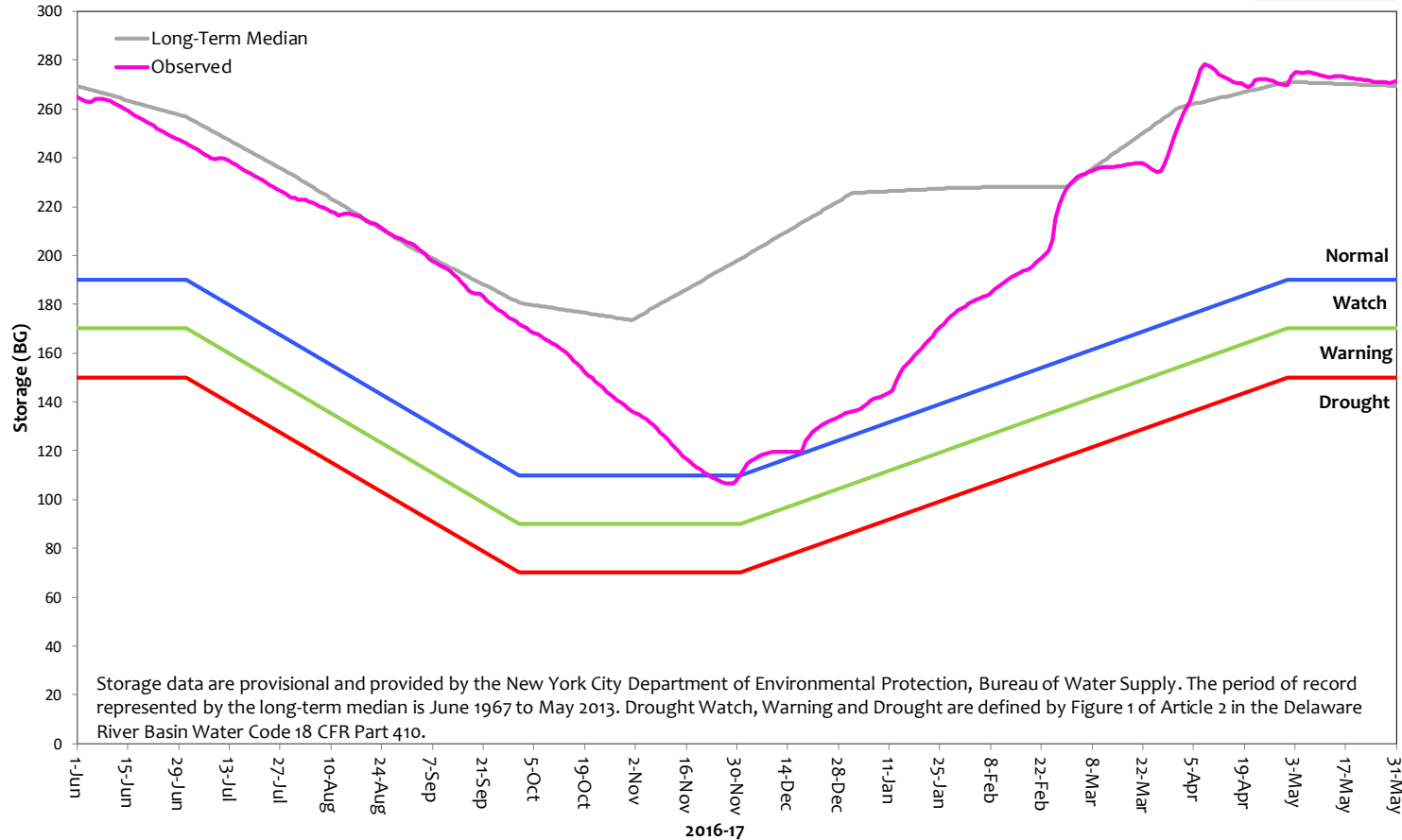


- \* **July 15:** NYS Statewide Drought Watch
- \* **July 25:** NJ Drought Watch for Sussex, Warren, Hunterdon, Mercer, and Morris Counties
- \* **August 2:** PA Drought Watch for Berks, Carbon, Lehigh, Northampton, Schuylkill and Lebanon Counties
- \* **September 6:** PA Drought Watch for Chester, Delaware and Philadelphia Counties
- \* **October 5:** NJ Drought Watch for Burlington, Camden, Gloucester, Monmouth, Ocean and Salem Counties
- \* **October 21:** NJ Drought Warning for Sussex, Warren, Hunterdon, Mercer, and Morris Counties
- \* **November 3:** PA Drought Warning for Carbon, Lehigh, Northampton; Drought Watch for Bucks, Luzerne, Lackawanna, Lancaster, Montgomery, Pike and Wayne Counties
- \* **November 23:** DRBC Drought Operations
- \* **January 18:** DRBC Normal Operations
- \* **February 5:** Normal Conservation Releases

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# Combined NYC Storage

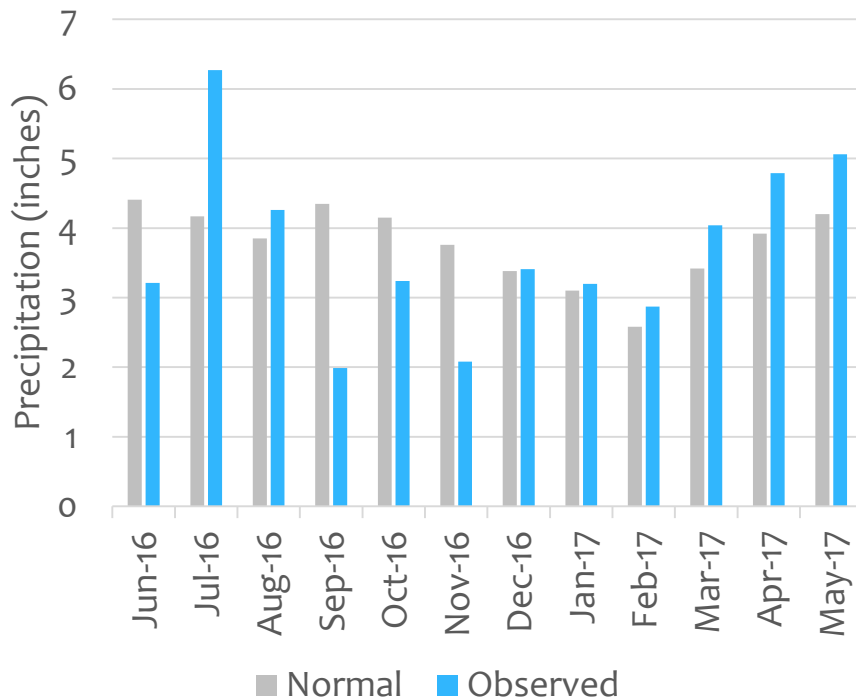
## New York City Delaware River Basin Storage



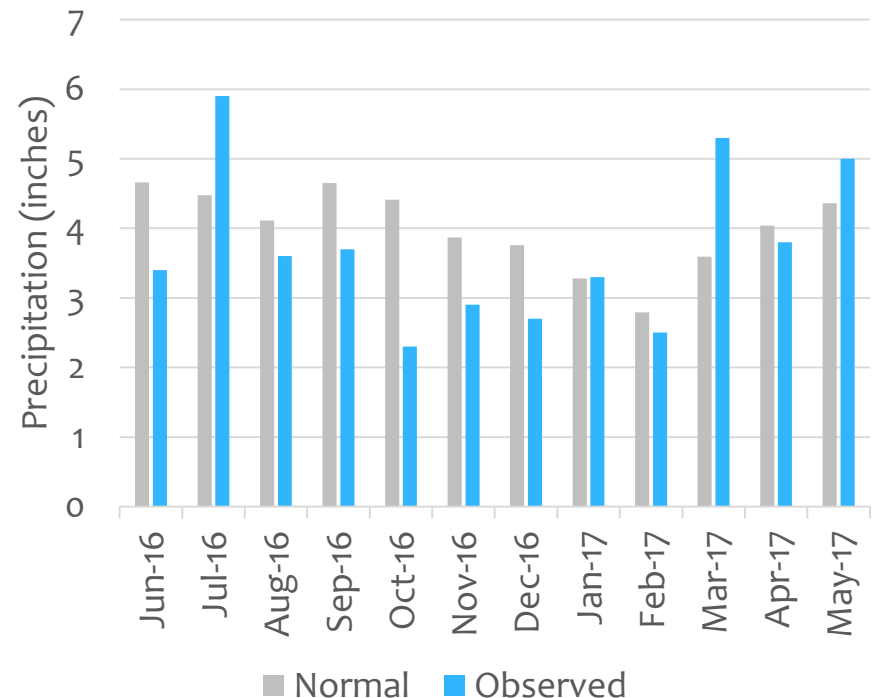
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# Climate

Average Precipitation above Montague, NJ  
June 2016- May 2017



Average Precipitation above Trenton, NJ  
June 2016-May 2017



Data Source: NOAA/NWS

Below normal precipitation in September, October and November resulted in drought conditions and initiation of drought operations on November 23. Normal precipitation in December and January resulted in the return to normal operations on January 18 and normal conservation releases on February 5.

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# Flow Objectives

## Water Released from NYC Reservoirs to meet Flow Objectives (MG)

Montague	Trenton*
66,676	5,768

\* 320 MG of IERQ water was used for thermal

## Water Released From Lower Basin Reservoirs to Meet Trenton Flow Objective (MG)

Beltzville	Blue Marsh
5,181	3,601

Water from DRBC Water Supply Storage

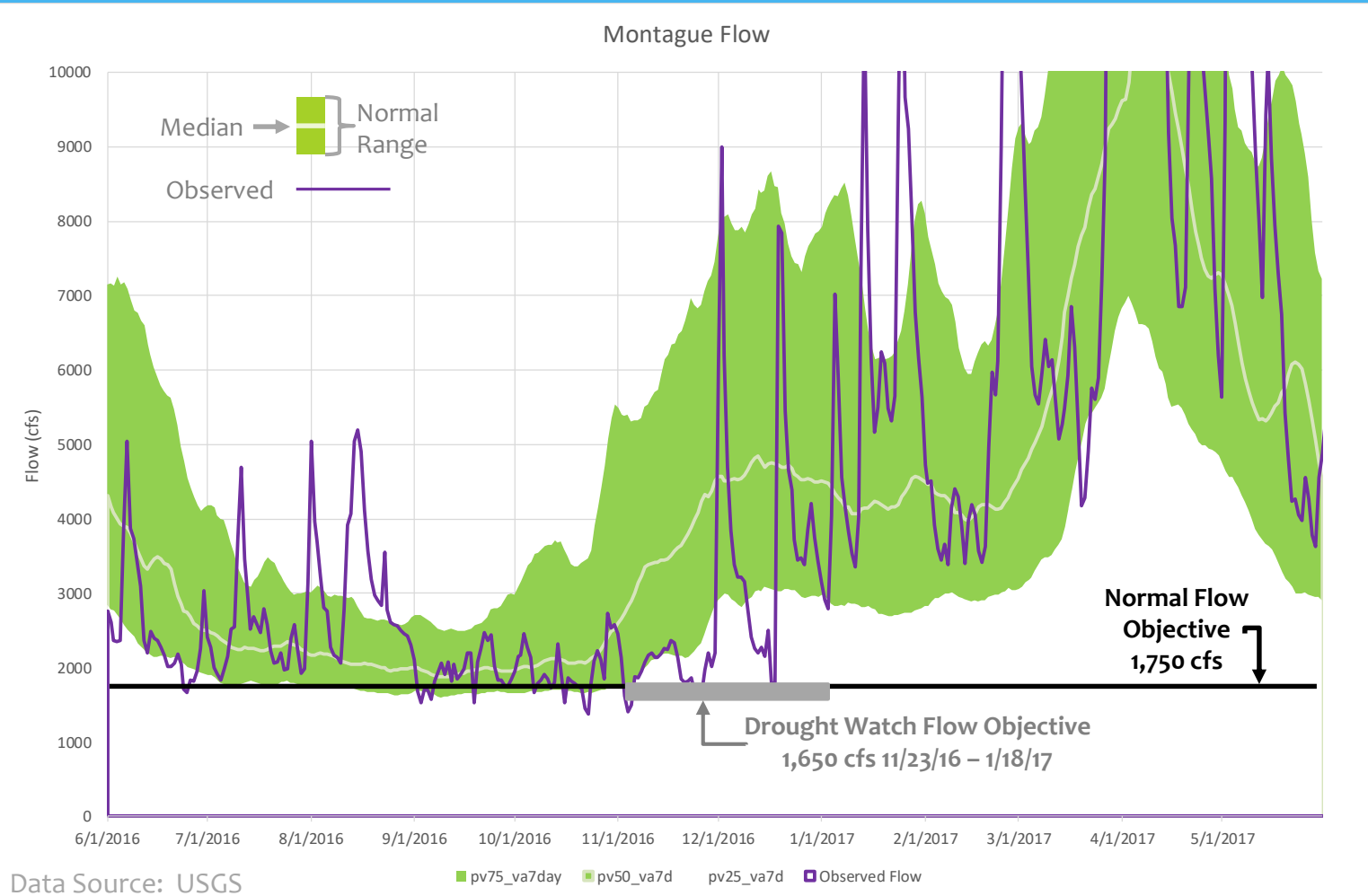
Flow Objectives were reduced from November 23, 2016 through January 18, 2017 as the result of DRBC drought operations. Misses were due to high precipitation predictions that did not materialize and cancellation of scheduled hydropower generation.

More water would have been needed from the NYC Reservoirs to meet the Montague Flow Objective had it not been for 10BG of water, released for maintenance, from Lake Wallenpaupack in September and October of 2017



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# Montague Flow

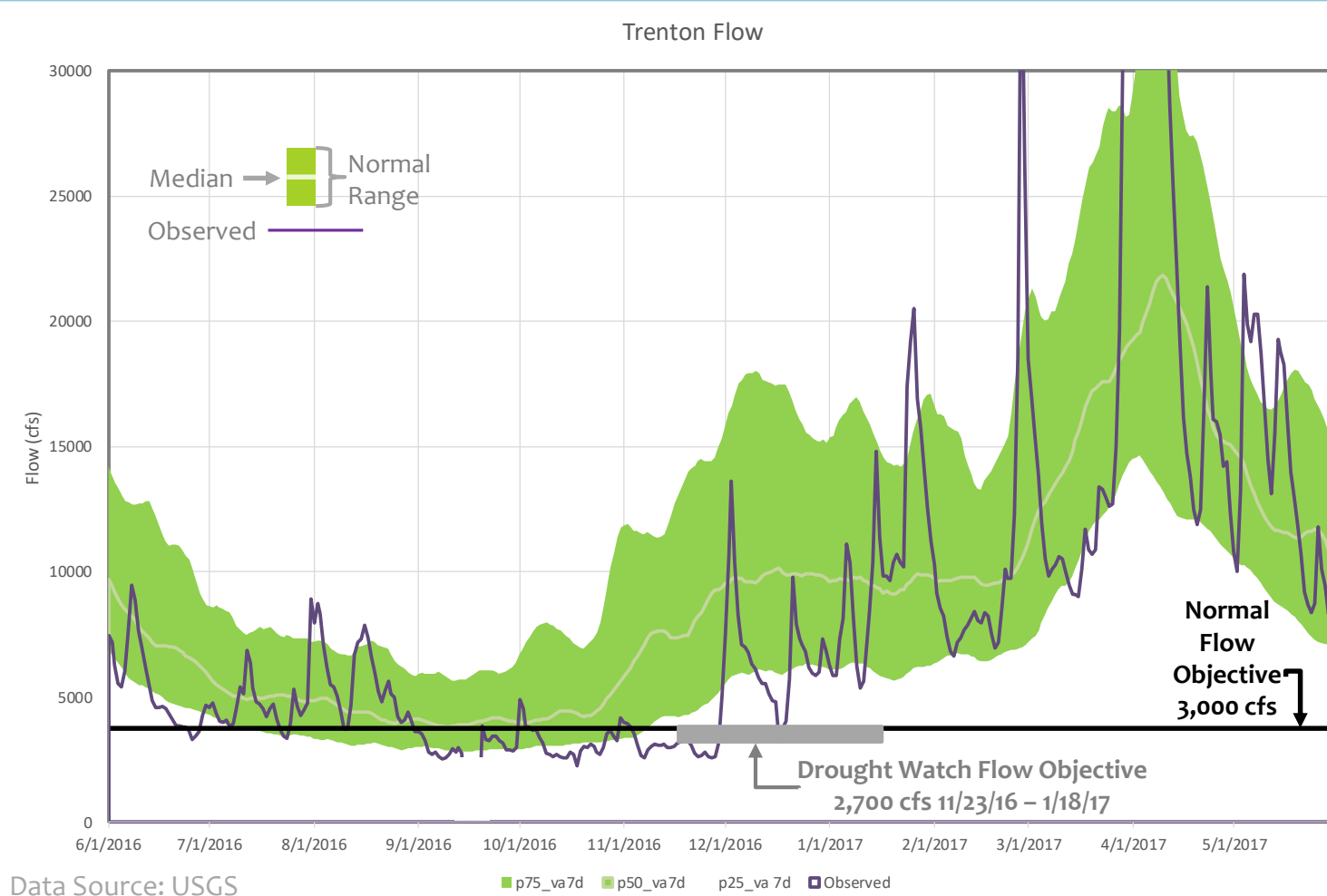


All data are provisional. These observations were recorded on the following day and may not reflect the final published values from USGS.



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# Trenton Flow



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# Diversions

## Monthly Average Daily Diversion (June 1, 2016 - May 31, 2017)

**New York**

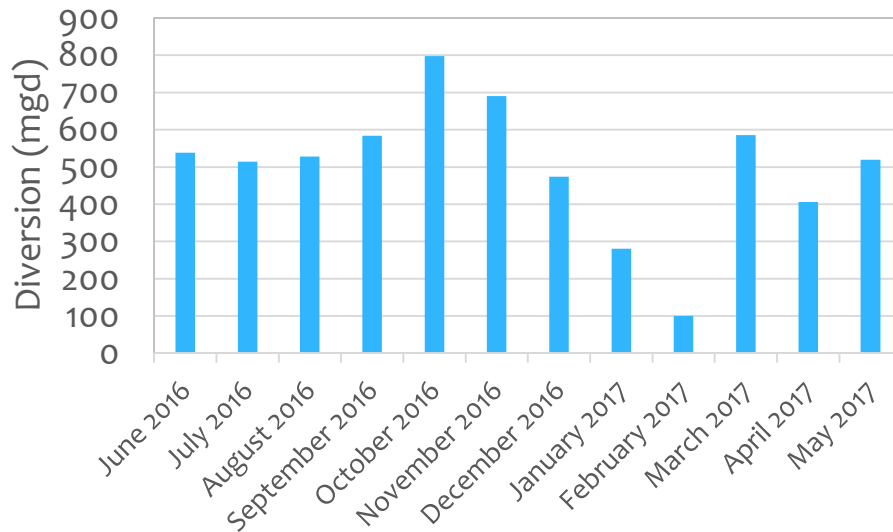
504 mgd

**New Jersey**

76.8 mgd

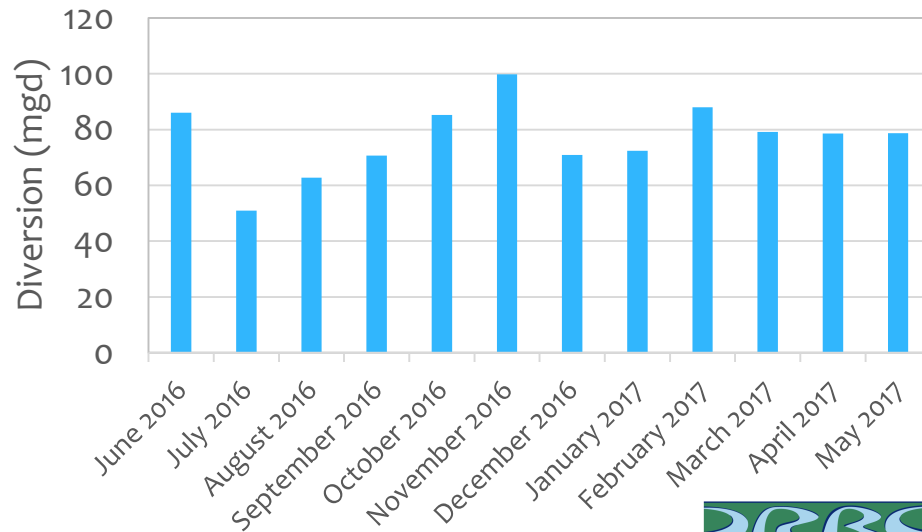
### New York

NYC Monthly Average Diversion



### New Jersey

NJ Diversion through Delaware and Raritan Canal



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# Conservation Releases

## Volume of Conservation Releases (MG)

	FFMP 2016-2017	REV1	Multiple of Revision 1	FFMP 2015-2016
Cannonsville	82,510	19,291	4.3	86,196
Pepacton	33,152	11,555	2.9	37,855
Neversink	18,194	7,708	2.4	22,267

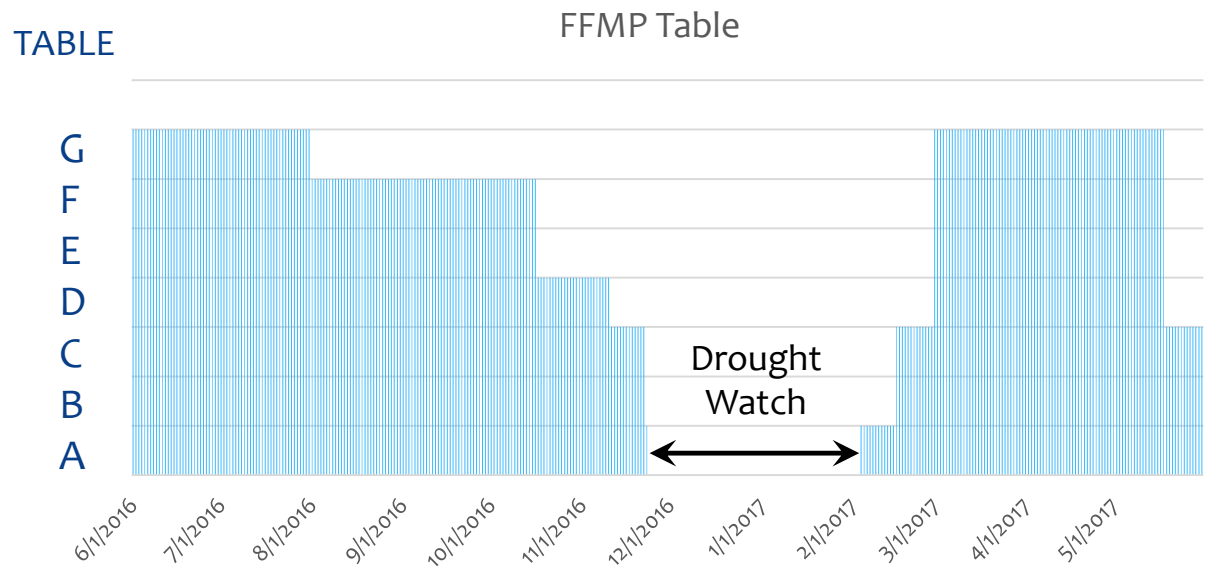
Values are the conservation releases required by the FFMP Tables **only**. All or a portion of the flow may have been used for meeting the Montague Flow Objective.

The conservation releases were less than those during the previous FFMP (2015-2016) because due to dry hydrologic conditions in the summer and fall there was less forecast available water. However, the conservation releases were still much greater than those that would have been provided by under Revision 1

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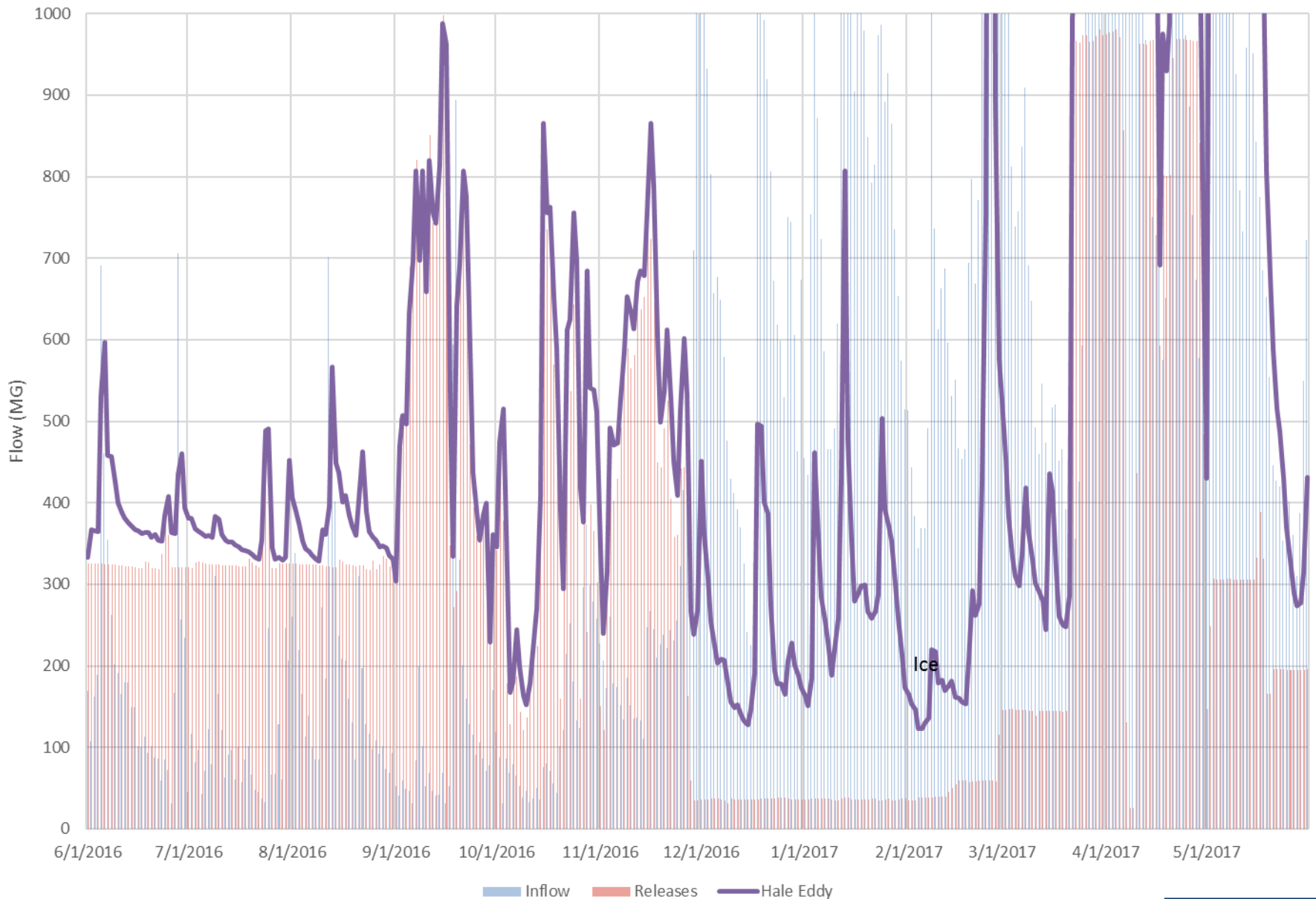
# Release Tables

Release Tables		
FFMP Table	Number of Days	Percent
G	140	38
F	77	21
E	0	0
D	25	7
C	38	10
B	0	0
A	13	4
Watch (L3)	72	20



Despite drought conditions during the late fall and early winter, conservation releases were at Table 4C or greater for 280 days (77 percent of the year) and Table 4G for 140 days (38 percent of the year).

# Cannonsville Inflow, Releases, Downstream Flow

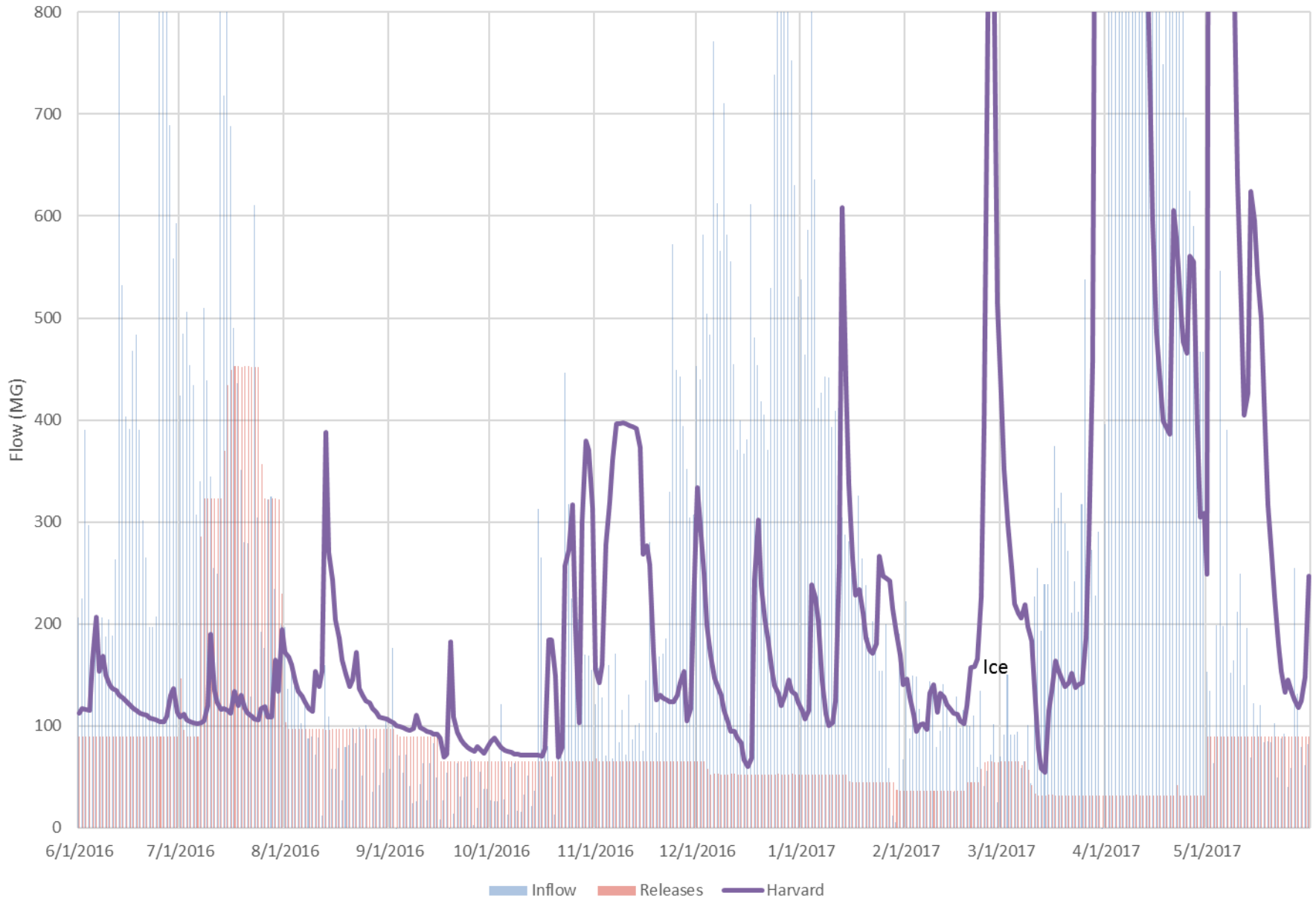


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Data Sources: USGS, NYC



# Pepacton Inflow, Releases and Downstream Flow

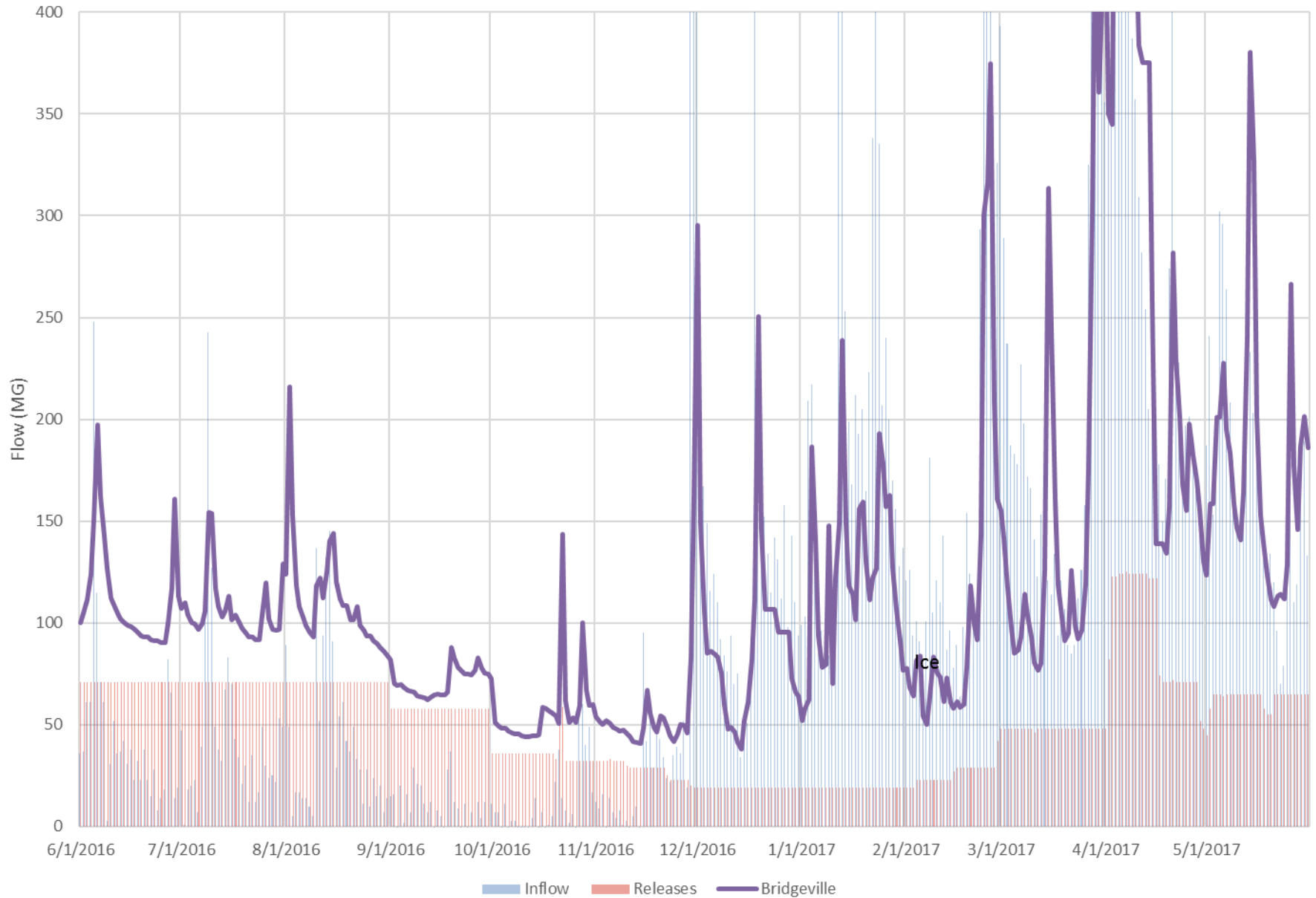


Data Sources: USGS, NYC

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# Neversink Inflow, Releases, Downstream Flow

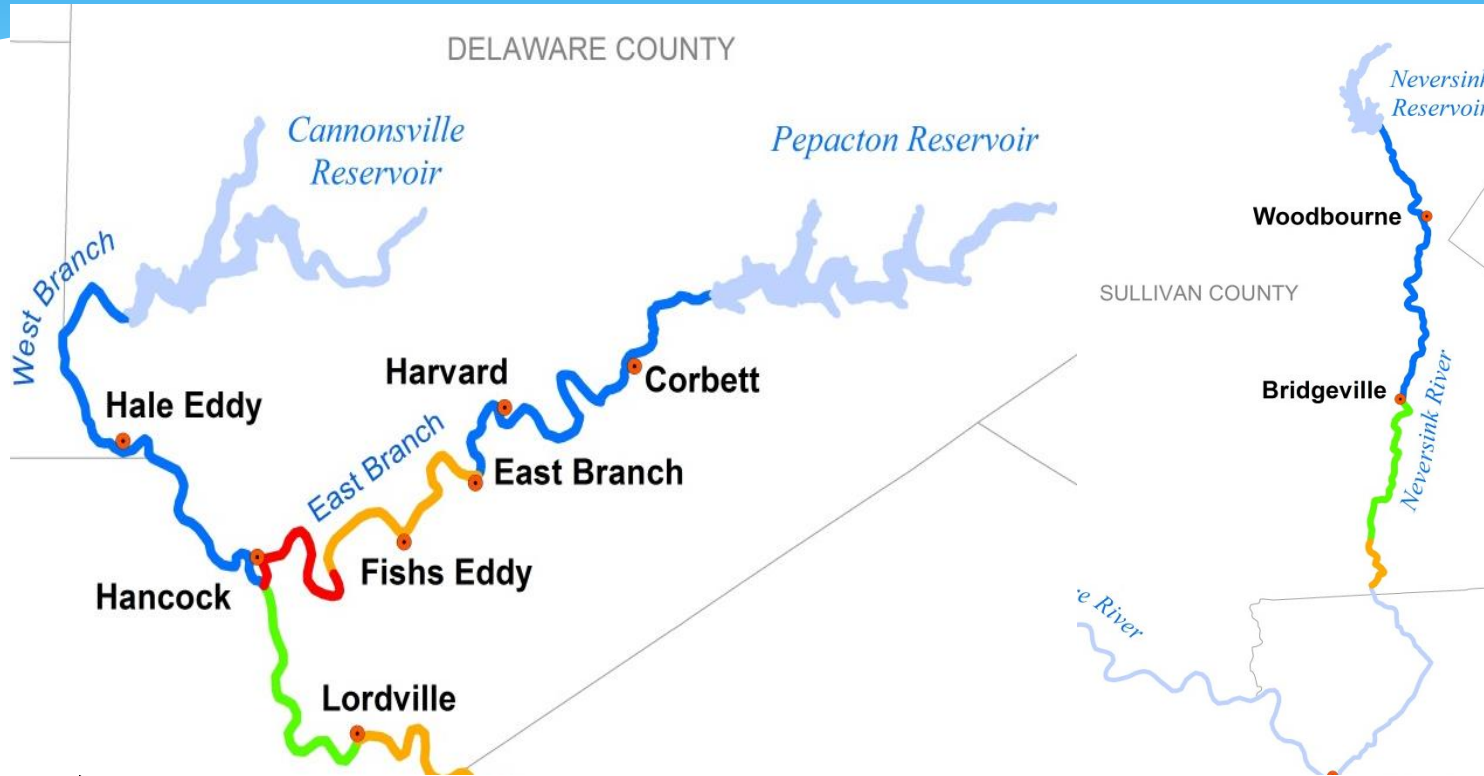


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Data Sources: USGS, NYC



# Habitat Protection (Temperature)



## Coldwater Ecosystem Protection Level

For non-drought years; Includes flow & water temperature.

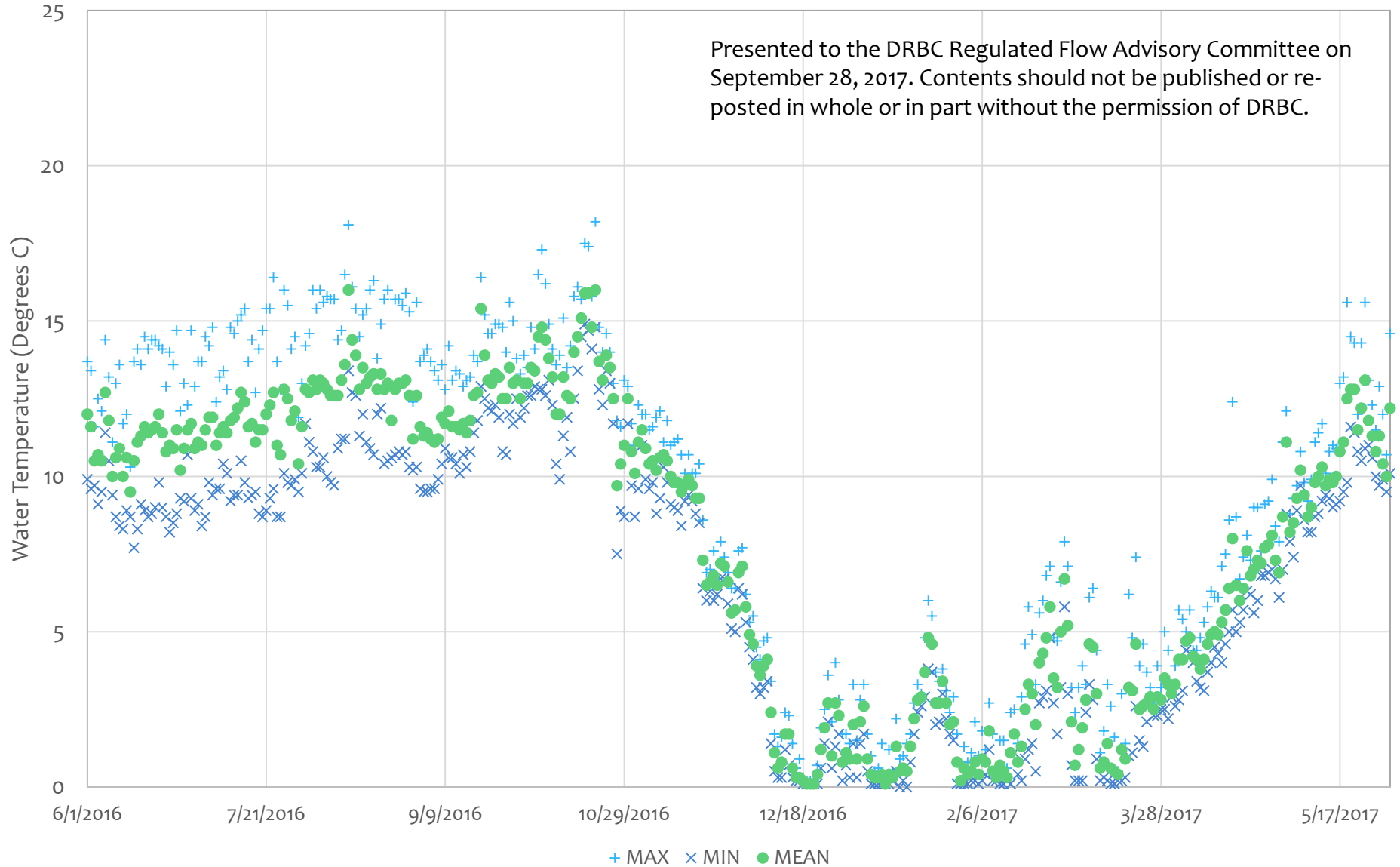
- Excellent
- Good
- Moderate
- Minimal

## GOALS for Excellent Habitat:

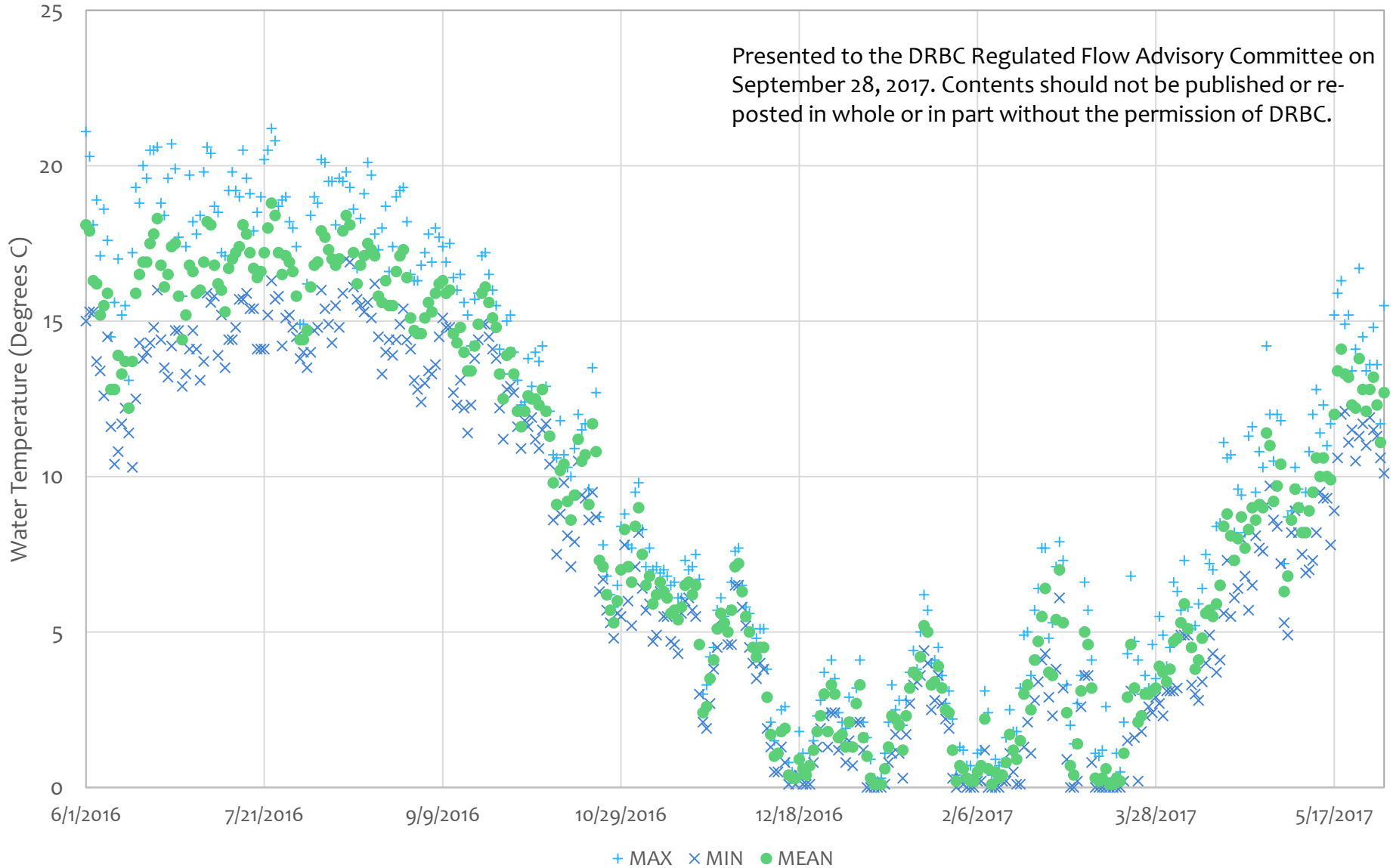
Summer temperatures typically less than 20C  
Rare exceedances of > 24C



# Temperature: West Branch Delaware River at Hale Eddy, NY

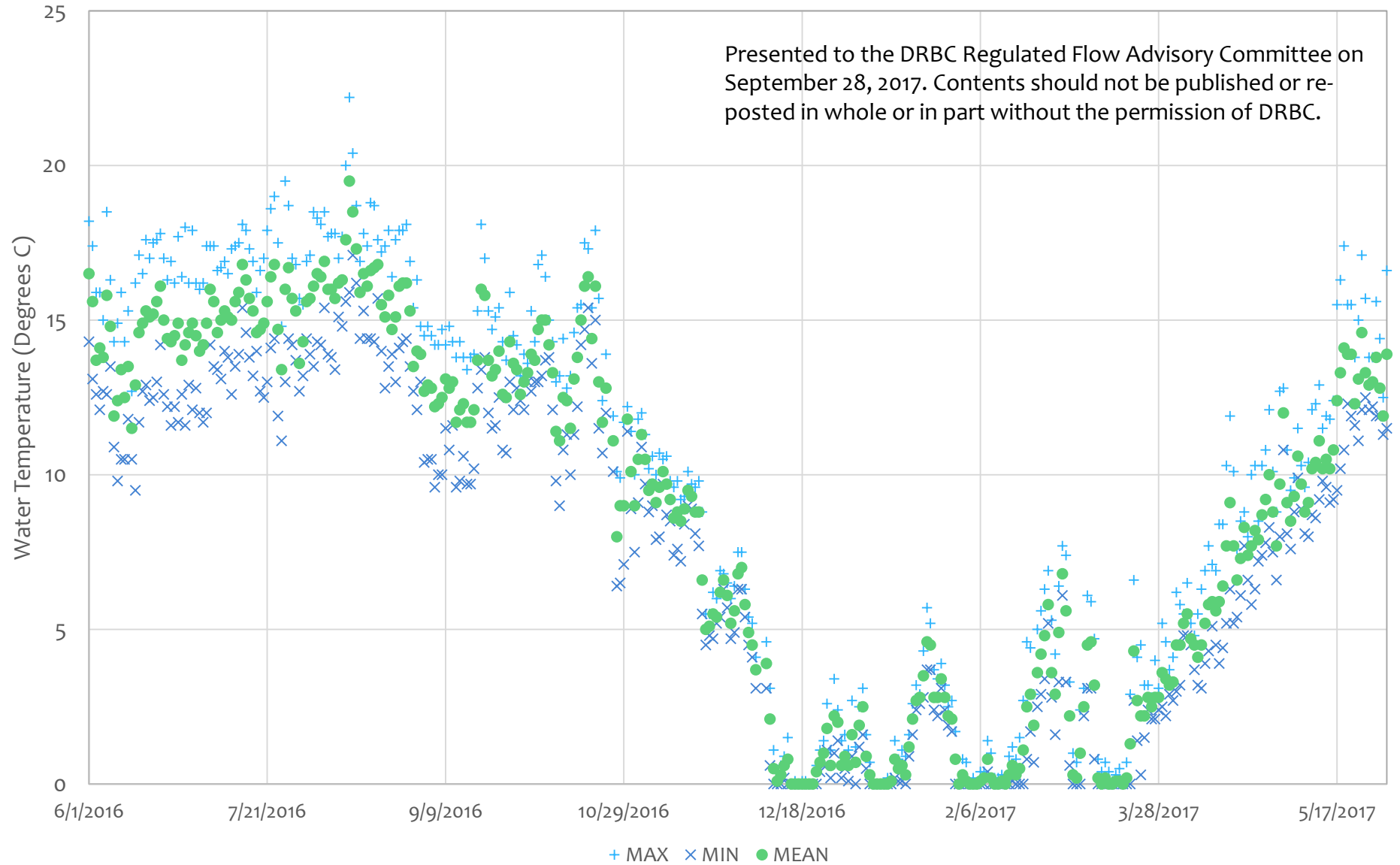


# Temperature: East Branch Delaware River at Harvard, NY



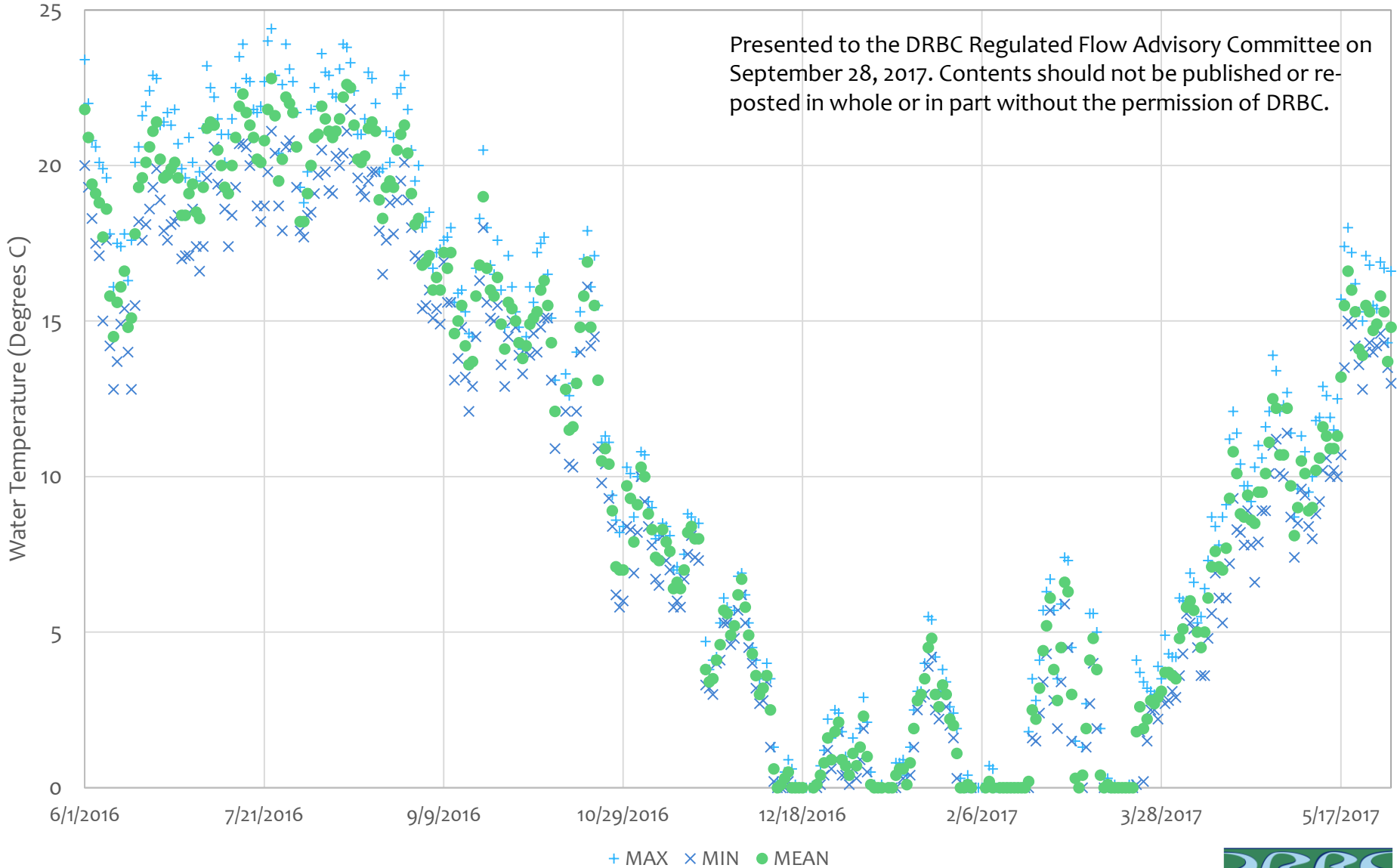
# Temperature: West Branch Delaware River at Hancock, NY

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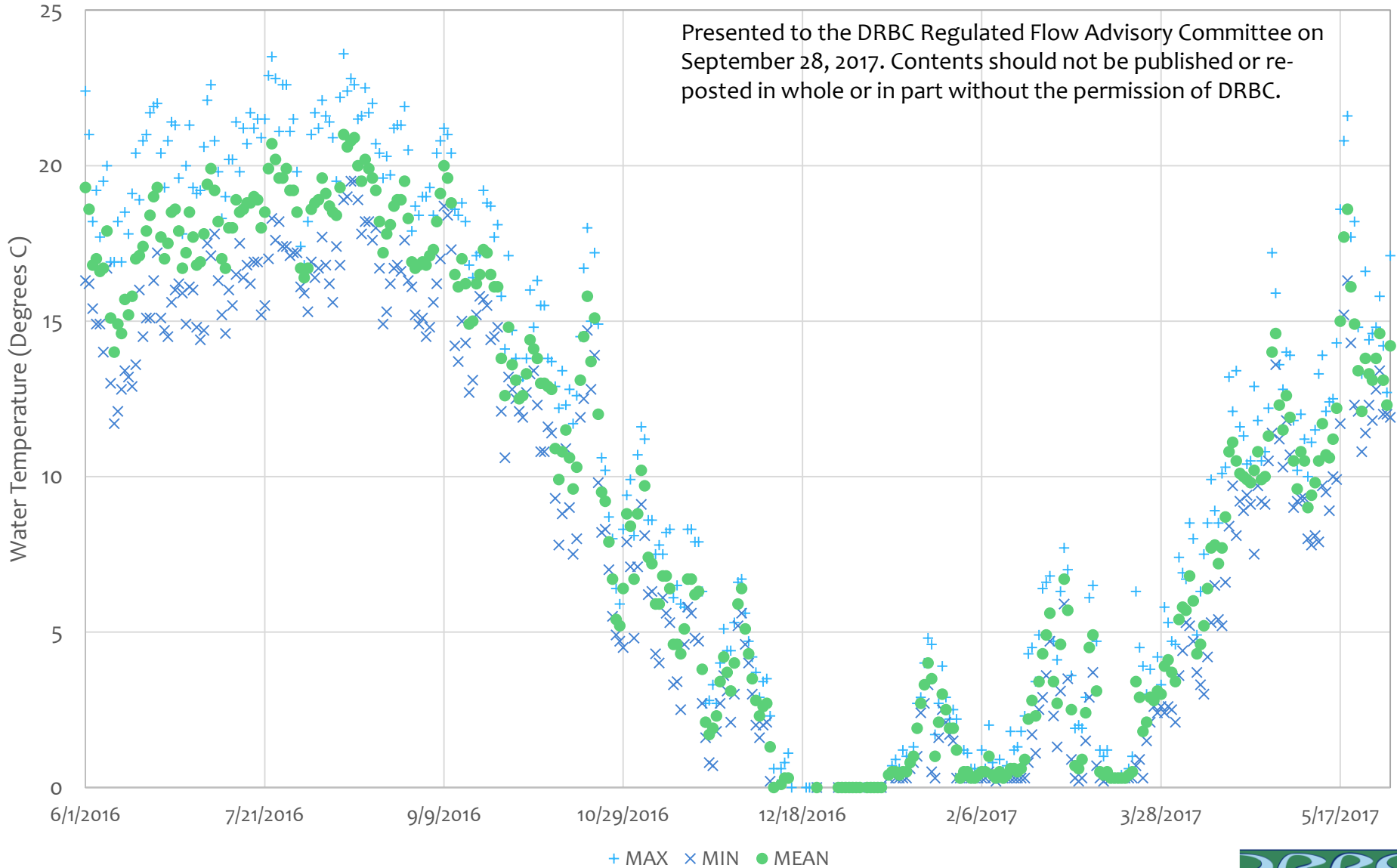
# Temperature: Delaware River at Lordville, NY

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# Temperature: Neversink River at Bridgeville, NY

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# Temperature

## GOALS for Excellent Habitat:

Summer temperatures typically less than 20C

Rare exceedances of > 24C

Locations	Exceedances of 24C		Exceedances of 20C	
	Days the Maximum Temperature was above 24C	Days the Average Temperature was above 24C	Days the Maximum Temperature was above 20C	Days the Average Temperature was above 20C
Hale Eddy	0	0	0	0
Harvard	0	0	16	0
Hancock	0	0	2	0
Lordville	1	0	75	51
Bridgeville	0	0	65	7

# New York Temperature Rankings

## June - October

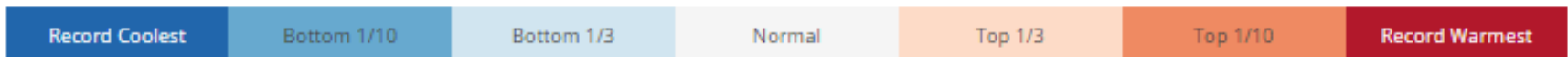
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### 2015 – last release season

PERIOD	AVG TEMP	20 <sup>TH</sup> CENTURY AVERAGE	DEPARTURE	RANK	WARMEST/COOLEST SINCE	RECORD
Jun - Oct 2015 5-month period	62.2°F (16.8°C)	60.9°F (16.1°C)	1.3°F (0.7°C)	99 <sup>th</sup> Coolest	Coolest since: 2014	1992
				24 <sup>th</sup> Warmest	Warmest since: 2012	2005
<i>Ties: 1906</i>						

### 2016 – this release season

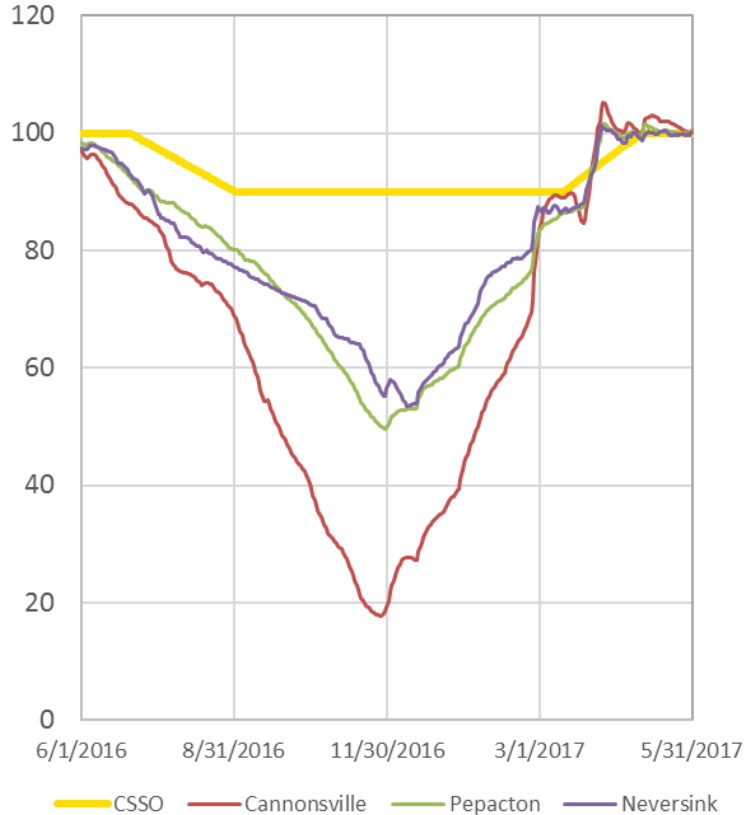
PERIOD	AVG TEMP	20 <sup>TH</sup> CENTURY AVERAGE	DEPARTURE	RANK	WARMEST/COOLEST SINCE	RECORD
Jun - Oct 2016 5-month period	63.7°F (17.6°C)	60.9°F (16.1°C)	2.8°F (1.5°C)	119 <sup>th</sup> Coolest	Coolest since: 2015	1992
				4 <sup>th</sup> Warmest	Warmest since: 2005	2005



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# Discharge/Spill Mitigation

Useable Storage and Conditional Seasonal Storage Objective



	<b>Spill Volume (MG)</b>	<b>Dates</b>	<b>Days</b>
Cannonsville	32,444	April-May	57
Pepacton	18,988	April-May*	41
Neversink	3,513	April-May*	23
* Intermittent			

	<b>L1 Discharge Mitigation Releases (MG)</b>	<b>Number of Days Above Conditional Seasonal Storage Objective</b>
Cannonsville	44,808	61
Pepacton	16,524	54
Neversink	6,216	35





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# Summary

- \* Dry conditions in the basin resulted in drought operations for 72 days (November 23, 2016 – February 5, 2017)
- \* Montague and Trenton flow objectives were met within operational constraints (weather forecasts, power generation)
- \* Despite drought conditions, conservation releases were at Table 4C or greater for 77% of the time and Table 4G for 38% of the time.
- \* Temperature goals met for tailwaters (no exceedances of 24C except 1 day at Lordville).
- \* Storage was below the Conditional Seasonal Storage Objective (CSSO) for 83 percent of the year.

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# Presentation Available on DRBC's Website:

[http://www.nj.gov/drbc/programs/  
flow/FFMP\\_PerformanceRpts.html](http://www.nj.gov/drbc/programs/flow/FFMP_PerformanceRpts.html)