



NYC Salinity Management

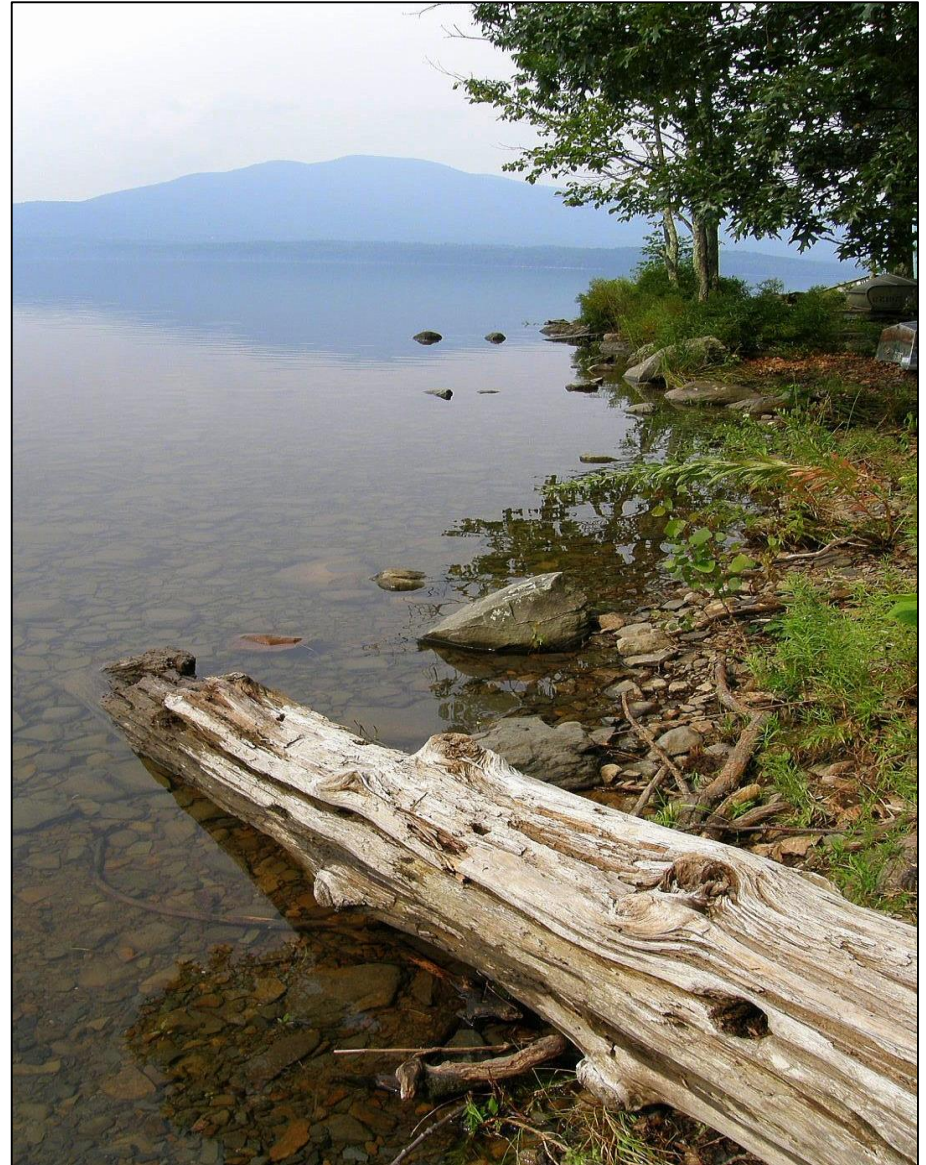
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October 16, 2019

Coalition for the Delaware River Watershed Forum

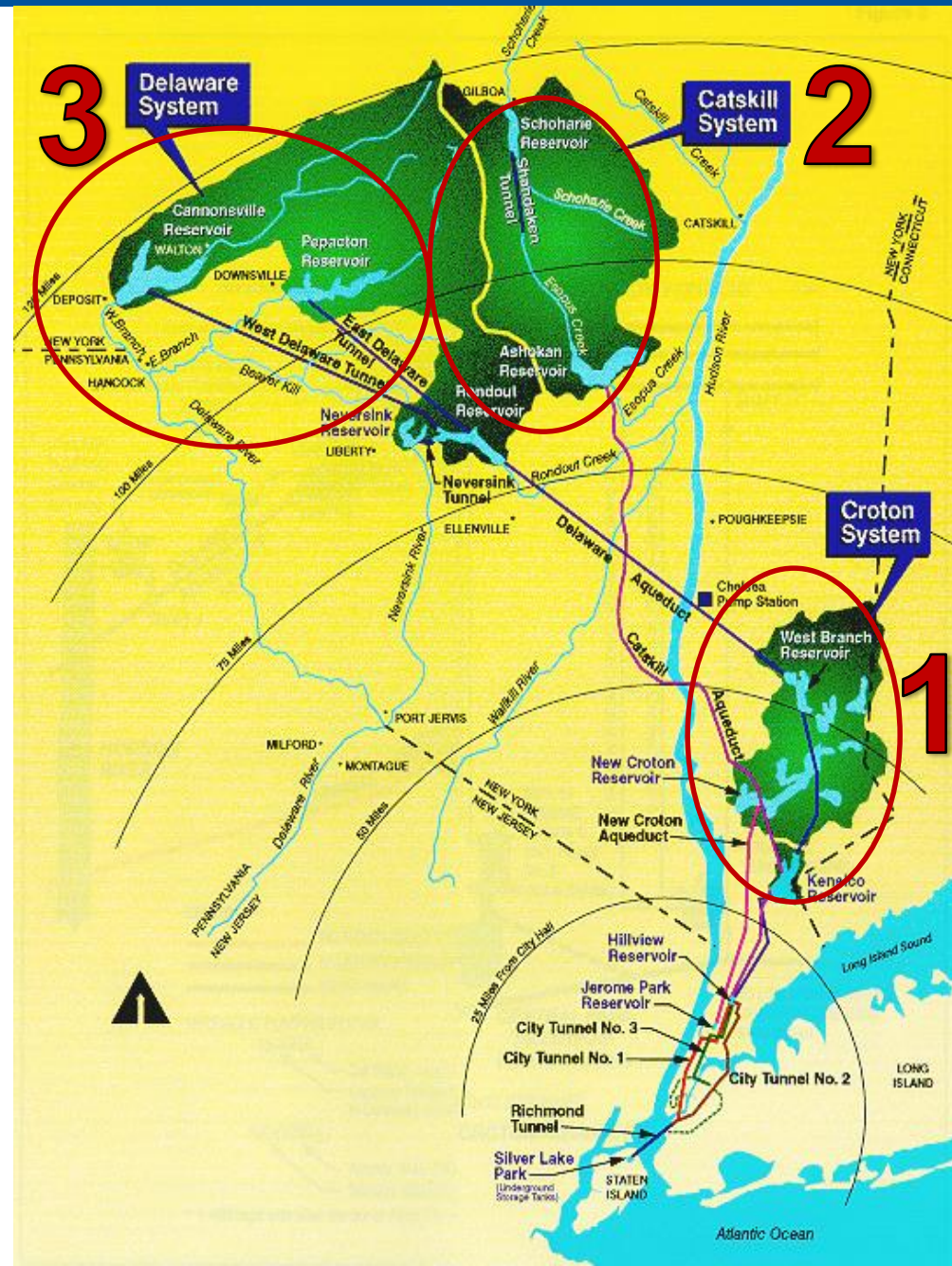
- Water supply overview
- History of the water supply
- Delaware flow management
- Good Faith Recommendations
- Salinity Regulations
- Current salinity management
- Concerns
- Research
- Questions



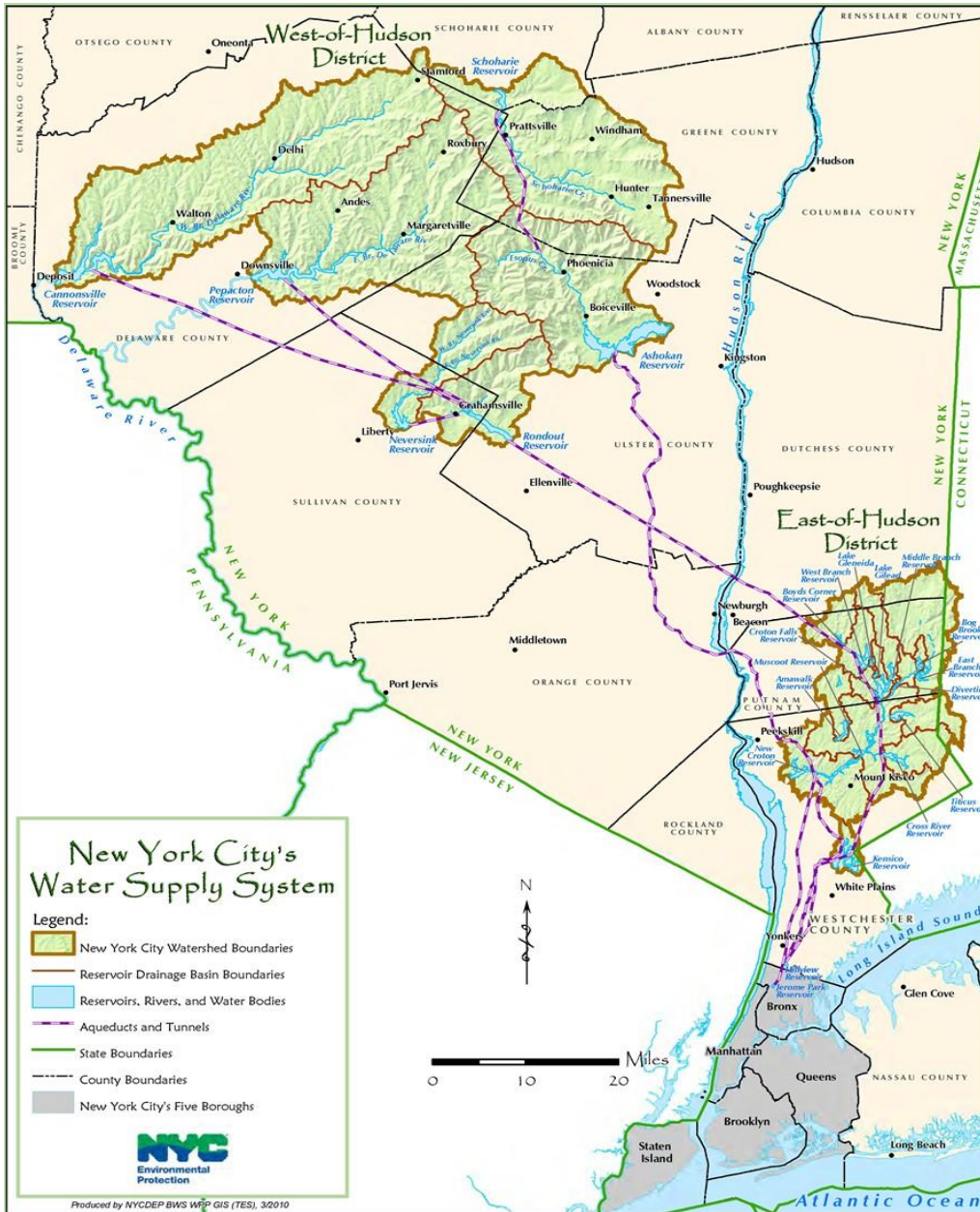
Development of Water Supply Systems

As New York City's population increased, new water supply reservoirs and facilities were constructed...

- **1830s–1890s:** Construction of the **Croton System** (East of the Hudson River)
 - **200,000+ water consumers**
- **1905-1928:** Construction of the **Catskill System** (West of the Hudson River)
 - **3.4+ million water consumers**
- **1937-1965:** Construction of the **Delaware System** (West of the Hudson River)
 - **6.9+ million water consumers**



Water Supply System Overview






- Primarily a surface water supply
- 19 reservoirs & 3 controlled lakes
- System Capacity: 570 billion gallons
- Serves 9.4 million people (1/2 of population of New York State)
- Delivers approx. 1.1 billion gallons per day
- Source of water is a 2,000 square mile watershed in parts of 8 upstate counties

Delaware System Overview

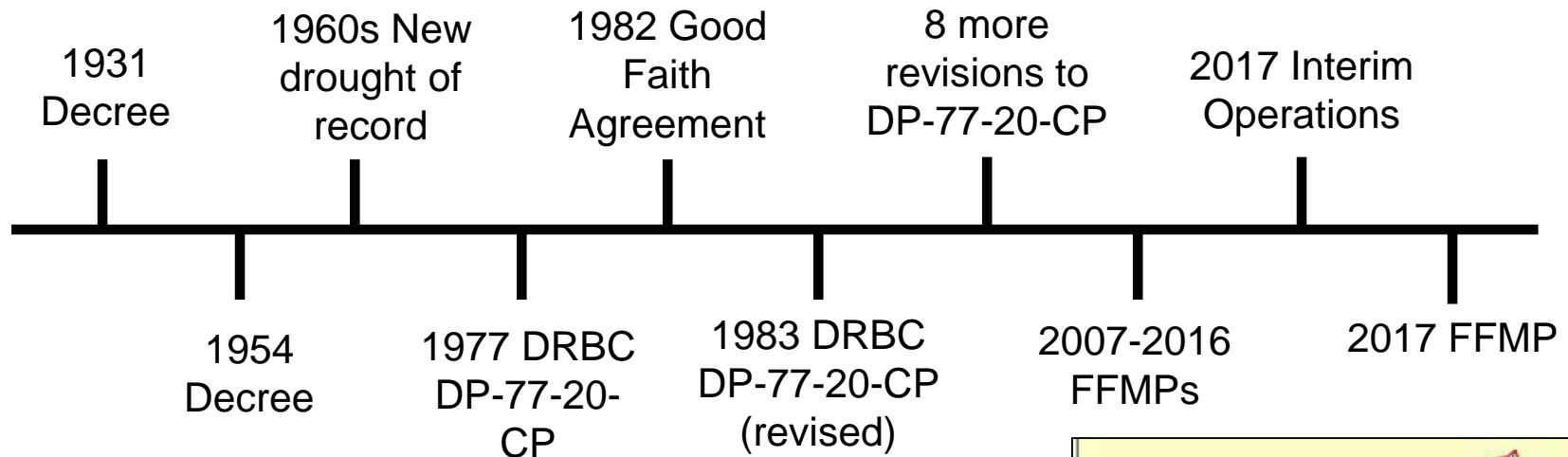
New York City West-of-Hudson Watershed *Delaware System*



Legend

-  Delaware System Reservoir Basins
-  Reservoirs and Major Tributaries
-  County Boundary

Delaware Flow Management



- Good Faith Agreement made 5 specific recommendations regarding salinity management in the Delaware
 - 1-Revised Salinity Objective
 - 3-Diversions, Releases and Reservoir Management During Drought
 - 4-Coordinated Operation of Other Existing Impoundments During Drought
 - 5-Construction or Modification Projects for Water Supply and Flow Augmentation for Salinity Control
 - 13-Regulatory Program to Limit Future Depletive Water Use



- Revised salinity objective
- Interim and long term salinity objectives
 - Interim-Limit salinity to a max 30 day average of 180 mg/L of chlorides and 100 mg/L sodium at River Mile 98 (Done)
 - Long Term-By 2000 limit salinity to a max 30 day average of 150 mg/L of chlorides and 83 mg/L of sodium at River Mile 98
- New storage should be used for salinity protection, augment water supply, improve environmental conditions, and water quality (ties into Recommendation 5)

All of the parties recognize the benefits of the salinity standards proposed in recommendation 1, but New York City abstains from supporting this recommendation because establishment of salinity standards is properly a matter for decision by the Commission. However, the City does agree with the specific drought operating schedules set forth in recommendation 3, which will assist in controlling salinity during drought periods over the course of this agreement.

Recommendation 3

- Diversions, Releases and Reservoir Management During Drought

TABLE 2

Flow Objectives for Salinity Control
During Drought Periods

Seven-day Average Location of "Salt Front," River-mile*	Flow Objective, Cubic Feet Per Second At:					
	Montague, N.J.			Trenton, N.J.		
	Dec-Apr	May-Aug	Sept-Nov	Dec-Apr	May-Aug	Sept-Nov
Upstream of R.M. 92.5	1600	1650	1650	2700	2900	2900
Between R.M. 87.0 and R.M. 92.5	1350	1600	1500	2700	2700	2700
Between R.M. 82.9 and R.M. 87.0	1350	1600	1500	2500	2500	2500
Downstream of R.M. 82.9	1100	1100	1100	2500	2500	2500

The City of New York joins in recommendation 3 but does not by doing so accept any general responsibility under the doctrine of equitable apportionment or otherwise to vary releases from the City's reservoirs in accordance with the location of the salt front.

Recommendation 4

- Develop a plan to use other existing impoundments during drought to complement the operating formula for NYC reservoirs to maintain reliable supplies for essential uses, to conserve water, and control salinity
- The plan should include criteria for Beltzville, Blue Marsh, F.E. Walter, Prompton and Nockamixon projects as well as the hydro reservoirs that belong to PP&L.
- Should be completed by July 1, 1983 and included in the Comprehensive Plan



Recommendation 5

- Construction or Modification Projects for Water Supply and Flow Augmentation for Salinity Control Interim and long term salinity objectives
 - Enlargement of F.E. Walter **(not done)**
 - Enlargement of Prompton Reservoir **(not done)**
 - Construction of Merrill Creek Reservoir **(completed and operational)**



F.E. Walter Reservoir

Recommendation 13

- Develop regulatory program to limit future depletive water use in such a way as to balance existing, new or expanded depletive use w/ the availability of storage capacity required to meet salinity objectives and include:
 - Control area in which regulatory program would operate would be downstream of Montague gage and upstream of the Chesapeake and Delaware Canal
 - Water available for allocation to new or expanded depletive uses within control area would be limited to flows in excess of flows needed to maintain salinity control objective during drought
- Depletive water use budget should be adopted and implemented NLT December 31, 1985



- 1983 DRBC D-77-20 Revised
- 2007 Flexible Flow Management Program (FFMP) City granted detachment from the salt front vernier
 - In conjunction with detachment and the increased NJ drought diversions the City agreed to contribute 4,050 cfs-days of additional water to the new IERQ, replacing the ERQ
- 2011 FFMP 1 year agreement with enhanced flood mitigation and fisheries releases using OST to evaluate Forecast-based Available Water (FAW)
 - City gave up detachment from the salt front vernier
 - The City contribution of 4,050 cfs-days of additional water to the new IERQ remained on the table
- One year extensions to 2011 FFMP without change until 2016
- Reversion to D-77-20 Revised and voluntary increased releases from NYC
- 2017 FFMP

Salinity in the Lower Delaware

- 2017 FFMP requires NYC to make releases based on the position of the salt front during drought emergency (Appendix A, Table 2)

Table 2

Interstate Operation Formula for Adjusting Montague and Trenton Flow Objectives during Drought Emergency (L5) Operations

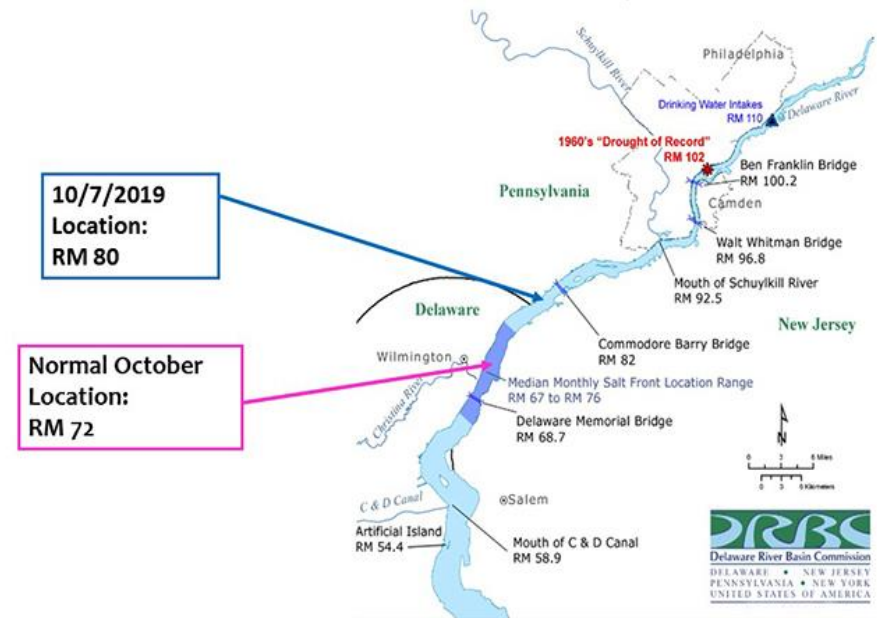
7-day average location of Salt Front*, River Mile**	Flow objective, cubic feet per second at:					
	Montague, NJ			Trenton, NJ***		
	Dec- Apr.	May- Aug.	Sept- Nov.	Dec- Apr.	May- Aug.	Sept- Nov.
Upstream of R.M. 92.5	1,600	1,650	1,650	2,700	2,900	2,900
Between R.M. 87.0 and R.M. 92.5	1,350	1,600	1,500	2,700	2,700	2,700
Between R.M. 82.9 and R.M. 87.0	1,350	1,600	1,500	2,500	2,500	2,500
Downstream of R.M. 82.9	1,100	1,100	1,100	2,500	2,500	2,500

* Defined as the 250 milligrams per liter isochlor in the Delaware Estuary.

**Measured in statute miles along the navigation channel from the mouth of Delaware Bay.

*** The Trenton Equivalent Flow Objective is achieved if the sum of flows observed at the USGS Trenton gaging station, releases in excess of conservation releases from Blue Marsh Reservoir, and an amount to account for water withdrawn above Trenton and returned below the gage is greater than the Trenton Flow Objective listed above.

Salt Line Location: October 7, 2019

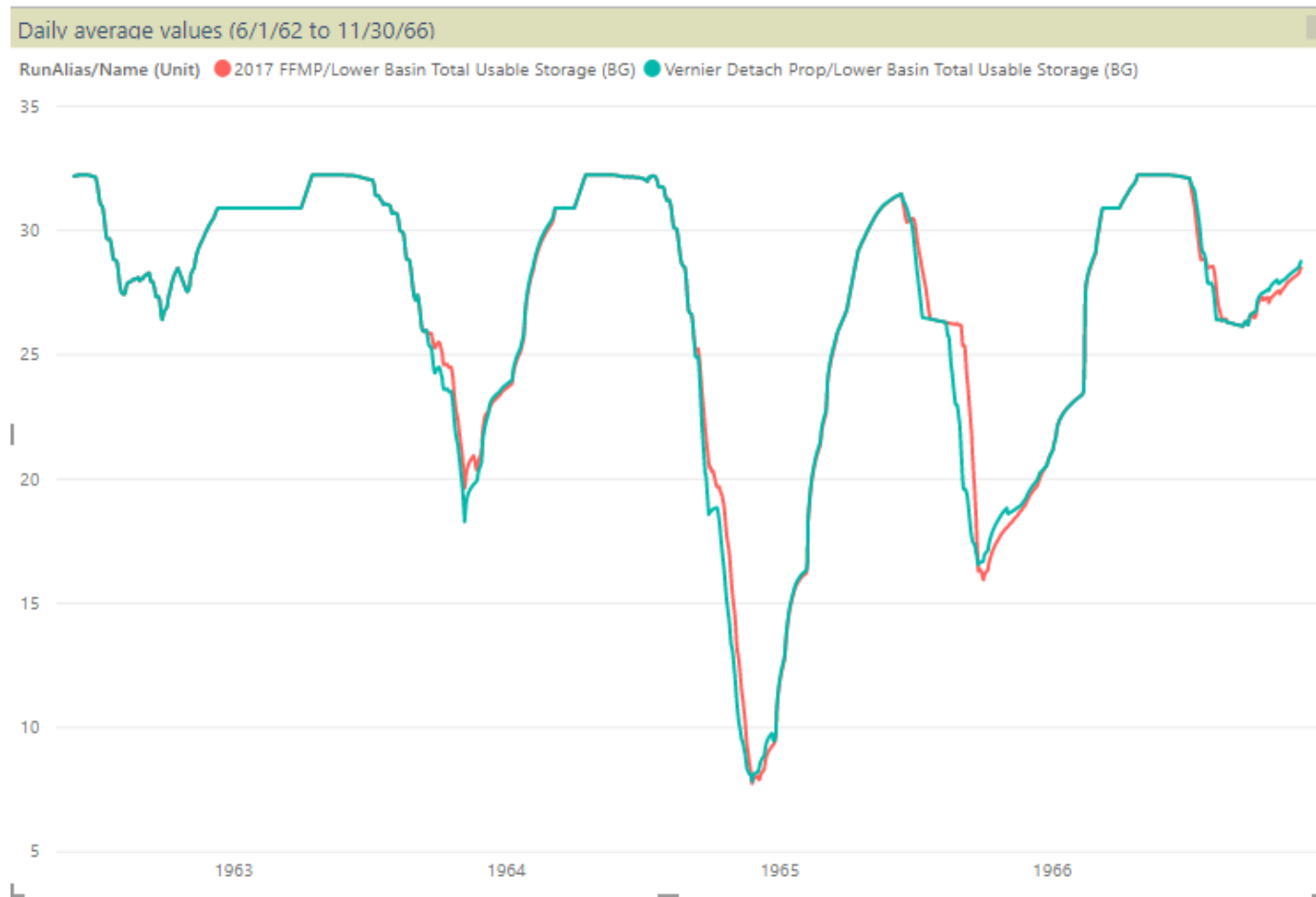


- Ensuring long-term water supply reliability and water resources management
- Water released with little benefit early in a drought is not available for either direct water supply or salinity repulsion in critical circumstances
- It is essential to ensure that all water released from storage provides substantial benefits
- The development of a new salinity strategy for the lower basin
 - Getting the most out of existing infrastructure
 - A reliable salinity model is required to assess alternatives
 - 2017 FFMP Salinity Study
 - F.E. Walter Re-evaluation Study



Vernier Detachment Approach

- Vernier Detachment requires a substitute for the salt-front dependent flow requirements at Montague & Trenton (2017 FFMP Table 2)
 - Substitute a constant or seasonally-dependent flow requirement that provides similar performance as the 2017 FFMP
 - Add pulse releases



- Under a repeat of the 1960's drought and current FFMP operations, NYC and Lower Basin reservoirs get very close to empty
- Revised operations of the F. E. Walter conservation storage would provide a much needed buffer
- Water Code allows F. E. Walter to store an additional 11.3BG during drought
- However, waiting for a drought declaration means additional storage is not available in the first year of a drought

F. E. Walter Operations in DRBC Water Code (2013)

TABLE 3. TEMPORARY EMERGENCY WATER SUPPLY STORAGE AT F.E. WALTER RESERVOIR (PURSUANT TO DROUGHT DECLARATION)

F.E. Walter Reservoir- (DA 288 sq. mi.)	Elevation (ft./s.l.d)	Surface Area (acres)	Storage		
			(acre-ft.)	(bg)	(inches runoff)
Drought/ Summer Pool*	1392	824	36,458	11.88	2.37
Drought/ Winter Pool**	1370	587	20,831	6.79	1.36
Normal Pool	1300	80	1,793	0.58	0.12
	1245	0	0	0	0

* Drought summer pool = 11.30 billion gallons of temporary water supply storage (32% of flood control storage).

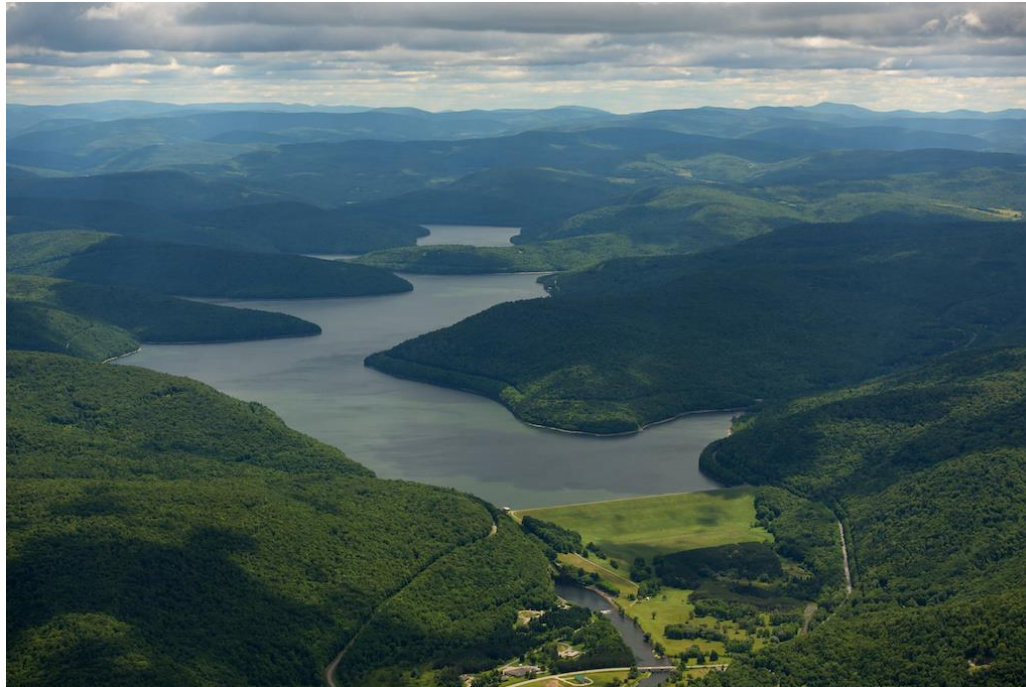
** Drought winter pool = 6.21 billion gallons of temporary water supply storage (18% of flood control storage).

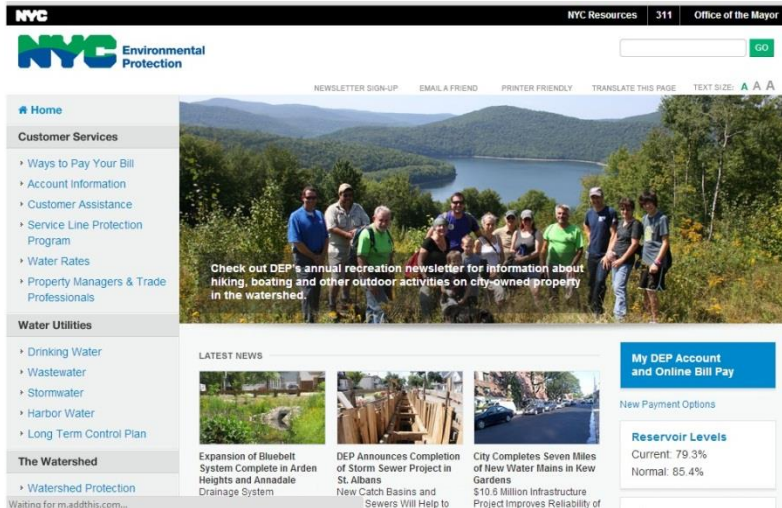
Benefits of Alternate Operations

- Significant storage buffers under 1960's hydrology in NYC and all Lower Basin Reservoirs
- Increased NJ Diversions during drought (watch, warning and emergency)
- Vernier Detachment while preserving storage in the NYC reservoirs and with comparable salinity protection



- Maintain current salinity management operations in 2017 FFMP
- Continue to work with the Decree Parties to establish a long term flow management plan for the Basin
- Continue to explore options to provide comparable protection in order to achieve detachment from the salt front
- Work collaboratively with Decree Parties, NJ American Water, Suez Water, PWD and other stakeholder groups on 2017 FFMP Salinity Study
- F.E. Walter Re-evaluation Study





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