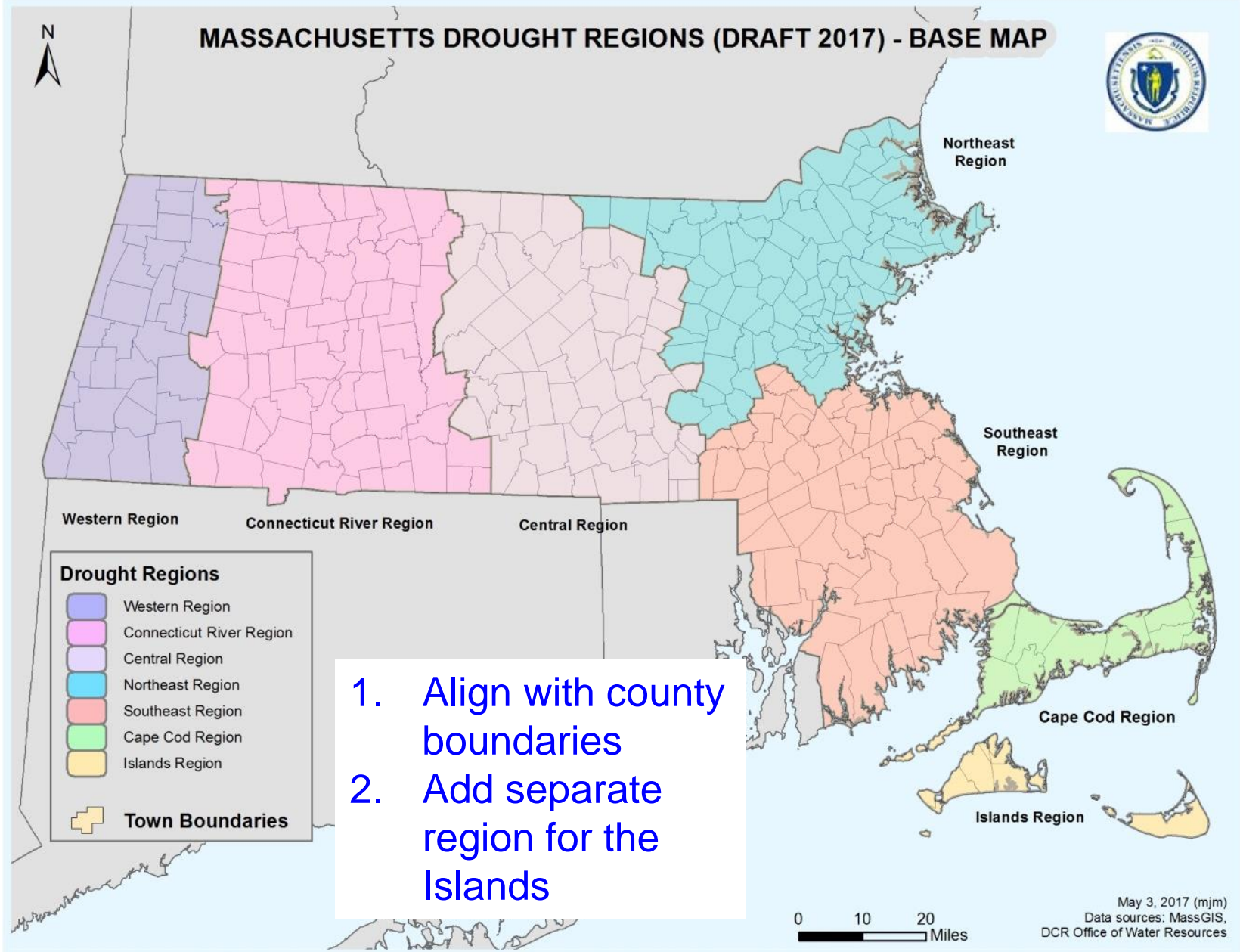# Update on Revisions to the Massachusetts Drought Management Plan

March 14, 2018

Presentation Overview

- Review key components of current plan and proposed changes
  - Drought Regions
  - Drought levels
  - Indicators: Results of testing revised methods for Indicators

- Next Steps

7 Drought Regions

MASSACHUSETTS DROUGHT REGIONS (DRAFT 2017) - BASE MAP

Northeast Region

Southeast Region

Western Region

Connecticut River Region

Central Region

Cape Cod Region

Islands Region

Drought Regions

- Western Region
- Connecticut River Region
- Central Region
- Northeast Region
- Southeast Region
- Cape Cod Region
- Islands Region

Town Boundaries

1. Align with county boundaries
2. Add separate region for the Islands

0   10   20
Miles

May 3, 2017 (mjm)
Data sources: MassGIS,
DCR Office of Water Resources

Proposed Drought Levels

Drought Monitor	MA Proposed	MA Percentile Range	MA Alternatives	MA Current
D0: Abnormally Dry	Drought Level 1: Dry	>20 and ≤30%	Mild Drought	Advisory
D1: Moderate	Drought Level 2: Very Dry	>10 and ≤20%	Significant Drought	Watch
D2: Severe Drought	Drought Level 3: Critically Dry	>2 and ≤10%	Critical Drought	Warning
D3: Extreme Drought				
D4: Exceptional Drought	Drought Level 4: Emergency	≤2%	Emergency Drought	Emergency

Proposed Changes to Indicators

Indicator	Current	CHANGES
Precipitation-SPI	Normalized standard deviations; 2,3,6,12 month look-back periods	Add 9 and 24 month look-back periods (1 and 36 month for information only); Use new percentile ranges
Streamflow	Percentile from monthly average; Count months <25th percentile	Percentile from monthly median; Use new percentile ranges
Groundwater	Percentile from month end value; Count months <25th percentile	Use new percentile ranges
Reservoirs, Lakes and Ponds	Standard deviation; Size of reservoir	Percentile from month end value; Use new percentile ranges
Fire Danger – KBDI	0-800 units, as reported by Fire Chief	Determine threshold for highest drought level, TBD per Fire Chief
Crop Moisture	As reported by NOAA national model	Replace with an evapotranspiration index and at higher spatial resolution- TBD
Precipitation - % of Normal	2,3,6,12 look-back periods	Remove as indicator; Report to aid with communication to public

All indicators are calculated using the entire period of record available at each site. A site must have at least 10 years of data in order to be used.

A Regional Value for Each Indicator

- When determining a region specific value, should we use the 25th or 50th percentile value from among all station percentiles?

- Which method produces indicator levels best aligned with target drought frequencies?

Analyses completed: Calculated streamflow, groundwater and SPI indices for Northeast and Southeast regions using 3 methods - current DMP, new with 25th percentile, new with 50th percentile

Groundwater

By looking at occurrence of each drought level over existing record, we can check how well each method matches the target percentiles.

Period of Record, ~1957-2016, 711 months

Northeast

	Rev DMP		Current DMP	Target % of months	New DMP %tile
	25th %tile	50th %tile			
	PERCENT OF MONTHS				
Normal	58%	73%	91%	70%	
Drought Level 1	13%	10%	3%	10%	20-30%
Drought Level 2	14%	9%	3%	10%	10-20%
Drought Level 3	11%	6%	1%	8%	2-10%
Drought Level 4	4%	1%	2%	2%	<=2%

Period of Record, ~1951-2016, 652 months

Southeast

	Rev DMP		Current DMP	Target % of months	New DMP %tile
	25th %tile	50th %tile			
	PERCENT OF MONTHS				
Normal	58%	75%	91%	70%	
Drought Level 1	15%	10%	2%	10%	20-30%
Drought Level 2	12%	10%	2%	10%	10-20%
Drought Level 3	13%	5%	2%	8%	2-10%
Drought Level 4	3%	0.5%	3%	2%	<=2%

Streamflow

Period of Record, ~1931-2016, 1,025 months

Northeast	Rev DMP		Current DMP	Target % of months	New DMP %tile
	25th %tile	50th %tile			
	PERCENT OF MONTHS				
Normal	61%	**70%**	79%	70%	
Drought Level 1	12%	**10%**	11%	10%	20-30%
Drought Level 2	13%	**11%**	4%	10%	10-20%
Drought Level 3	11%	**8%**	4%	8%	2-10%
Drought Level 4	3%	**1%**	2%	2%	<=2%

Period of Record, ~1937-2016, 951 months

Southeast	Rev DMP		Current DMP	Target % of months	New DMP %tile
	25th %tile	50th %tile			
	PERCENT OF MONTHS				
Normal	55%	**71%**	73%	70%	
Drought Level 1	14%	**11%**	13%	10%	20-30%
Drought Level 2	15%	**11%**	5%	10%	10-20%
Drought Level 3	12%	**7%**	7%	8%	2-10%
Drought Level 4	4%	**1%**	3%	2%	<=2%

Precipitation - SPI

Period Of Record: ~1900 to 2016, 116 years

Northeast	Current DMP	Rev DMP– *worst of look back periods*		Target % of months
		25th%tile	50th%tile	
	PERCENT OF MONTHS			
Normal	76%	33%	**43%**	70%
Indicator Level 1	14%	15%	**16%**	10%
Indicator Level 2	9%	25%	**21%**	10%
Indicator Level 3	1%	20%	**16%**	8%
Indicator Level 4	0%	7%	**3%**	2%

Precipitation - SPI

Period Of Record: ~1900 to 2016, 116 years

| Northeast		Rev DMP– *worst of look back periods*		**Look back period:**		**2 mo**	**3 mo**	**6 mo**	**9 mo**	**12 mo**
	Current DMP			**Target % of months**	**Rev DMP**	**Rev DMP**				
		25th%tile	50th%tile		25th%tile	50th%tile				
				PERCENT OF MONTHS						
Normal	76%	43%	76%	70%	62%	70%	69%	70%	72%	71%
Indicator Level 1	14%	16%	14%	10%	13%	11%	13%	11%	10%	9%
Indicator Level 2	9%	21%	9%	10%	15%	12%	12%	12%	10%	12%
Indicator Level 3	1%	16%	1%	8%	8%	6%	5%	7%	7%	7%
Indicator Level 4	0%	3%	0%	2%	2%	1%	1%	1%	1%	1%

Precipitation - SPI

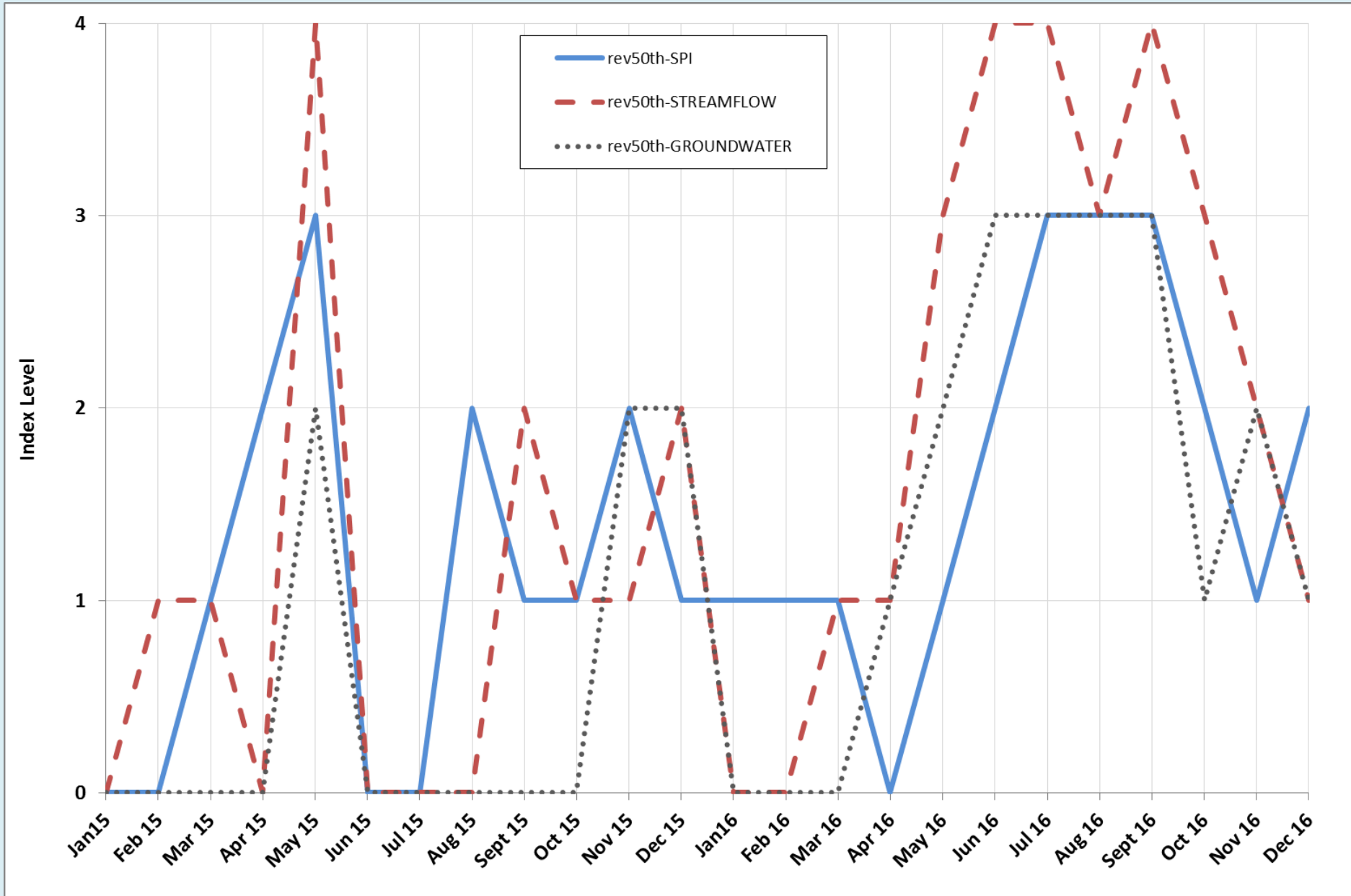**How to Use Look Back Periods?**

- Take the worst of all look back periods

- One short term (2,3,6 mo) and one long term (9,12 mo)

- Present all look back periods

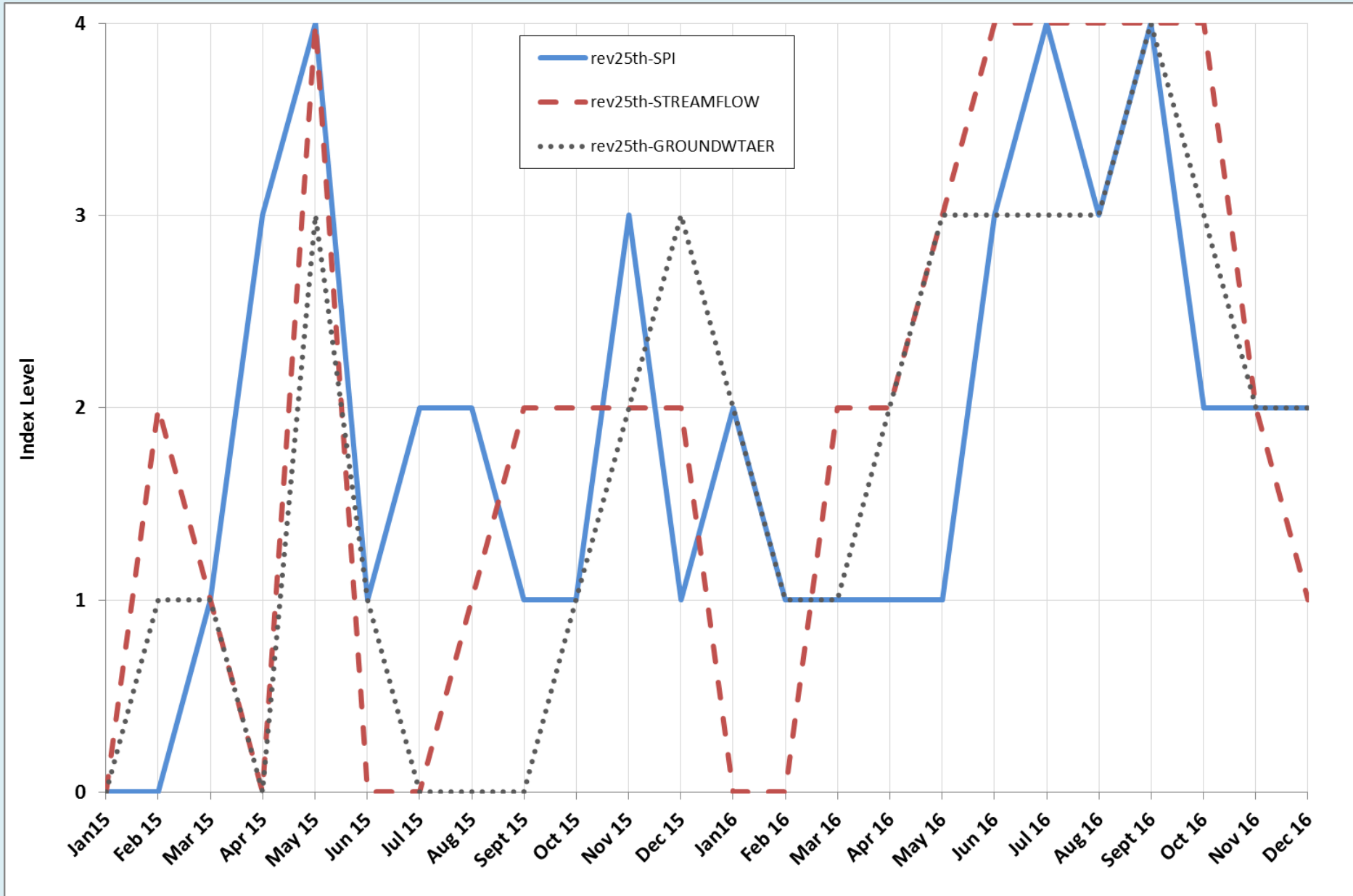The graphs show the timing of drought signal from each index.

Northeast
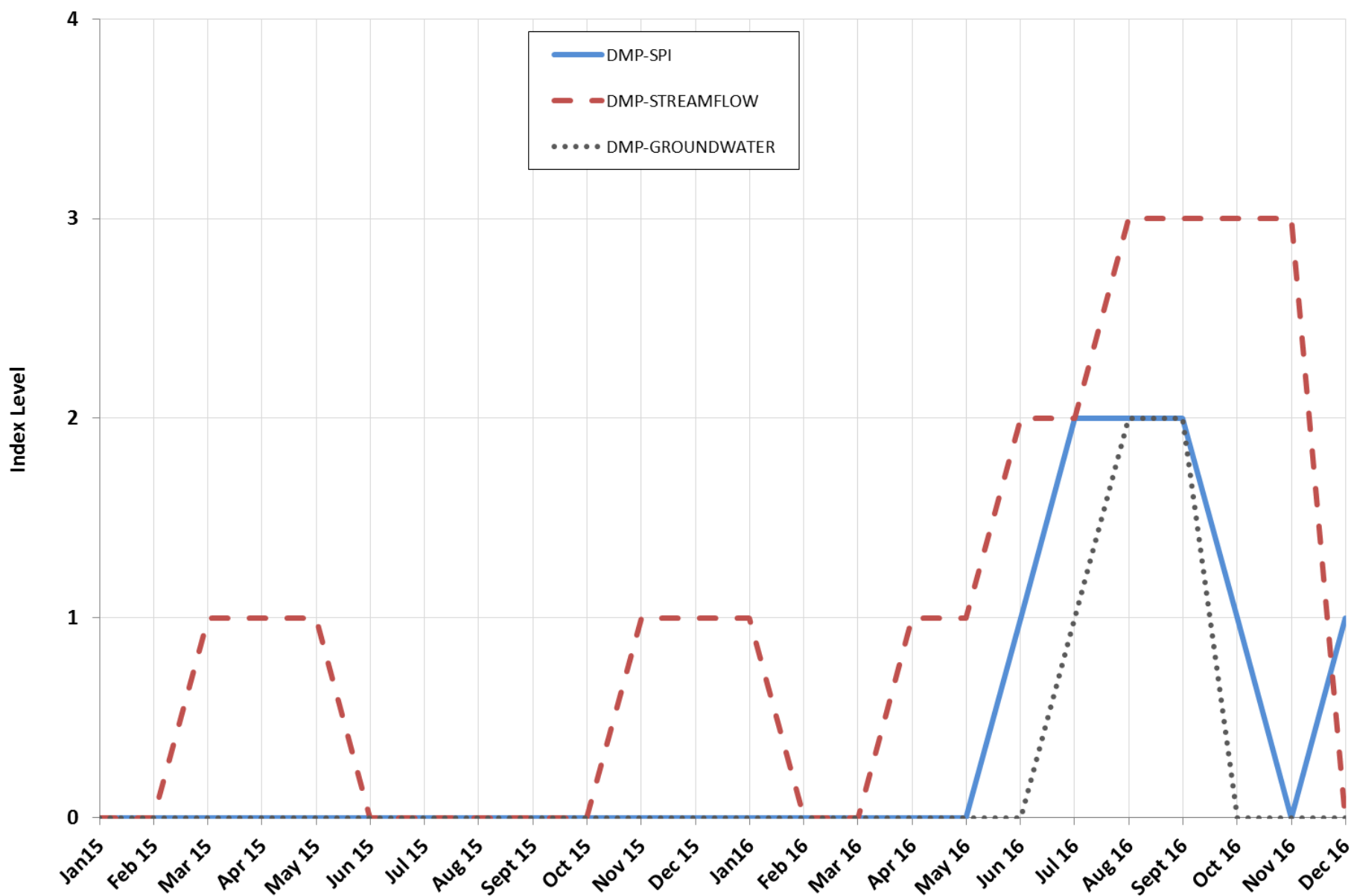
Northeast

Northeast

Questions/Comments