

Chesapeake Bay Model

Hydrologic base and critical periods

Communication of results

Robin Glas, U.S. Geological Survey, New York Water Science Center,
Troy, NY

rglas@usgs.gov

This information is preliminary or provisional and is subject to revision. It is being provided to meet the need for timely best science. The information has not received final approval by the U.S. Geological Survey (USGS) and is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.

Guiding Questions

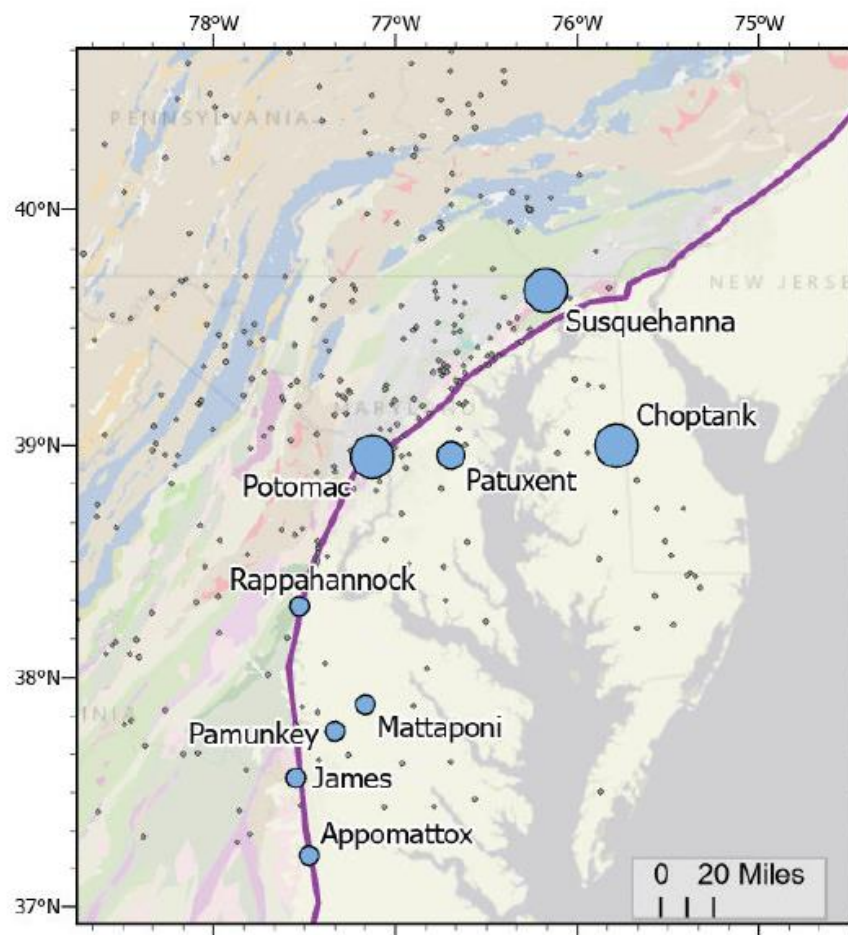
- What are the three proposed options?
 - Status Quo
 - Hybrid
 - New
- Why aren't more recent periods showing up as candidates?
- How have data and methods changed since the 2010 TMDL report?
- What would the three proposed options look like under the old methodologies?

Proposed options.

- Status Quo
 - Base period 1991-2000
 - Critical stress period 1993-1995
- Hybrid
 - Base period 1991-2000
 - Critical stress period 1996-1998
- New
 - Base period 1998-2007
 - Critical stress period 2004-2006

N-P effectiveness weights

(provided by the phase 6 model)



Not all freshwater inputs are equal.

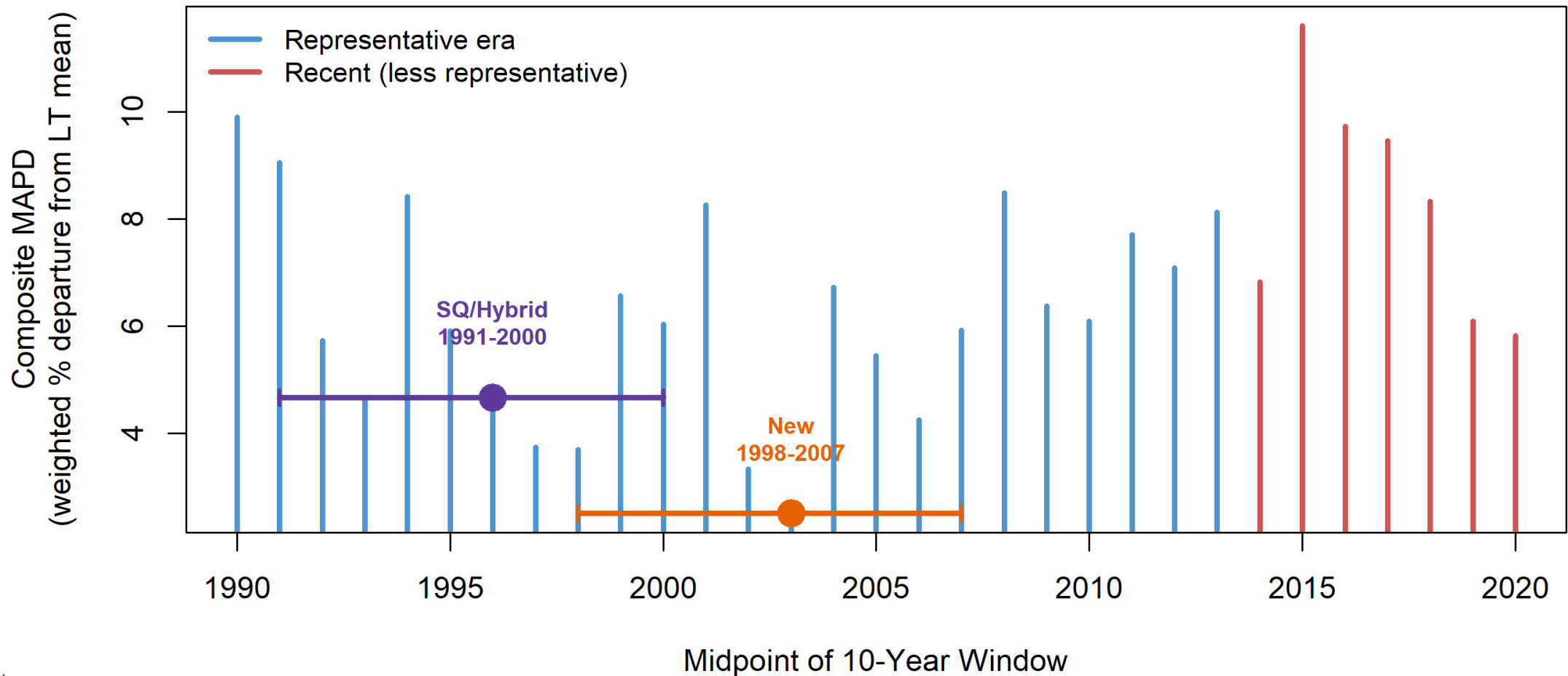
The nine RIM stations were weighted by how much each river's nitrogen and phosphorus affects Bay dissolved oxygen, not by flow volume alone.



U.S. Geological Survey
(USGS), Esri, HERE, Garmin,
USGS, EPA, NPS

Base period- why aren't we seeing more recent candidates?

Representativeness Over Time — Recent Windows Score Poorly



Preliminary Information-Subject to Revision. Not for Citation or Distribution

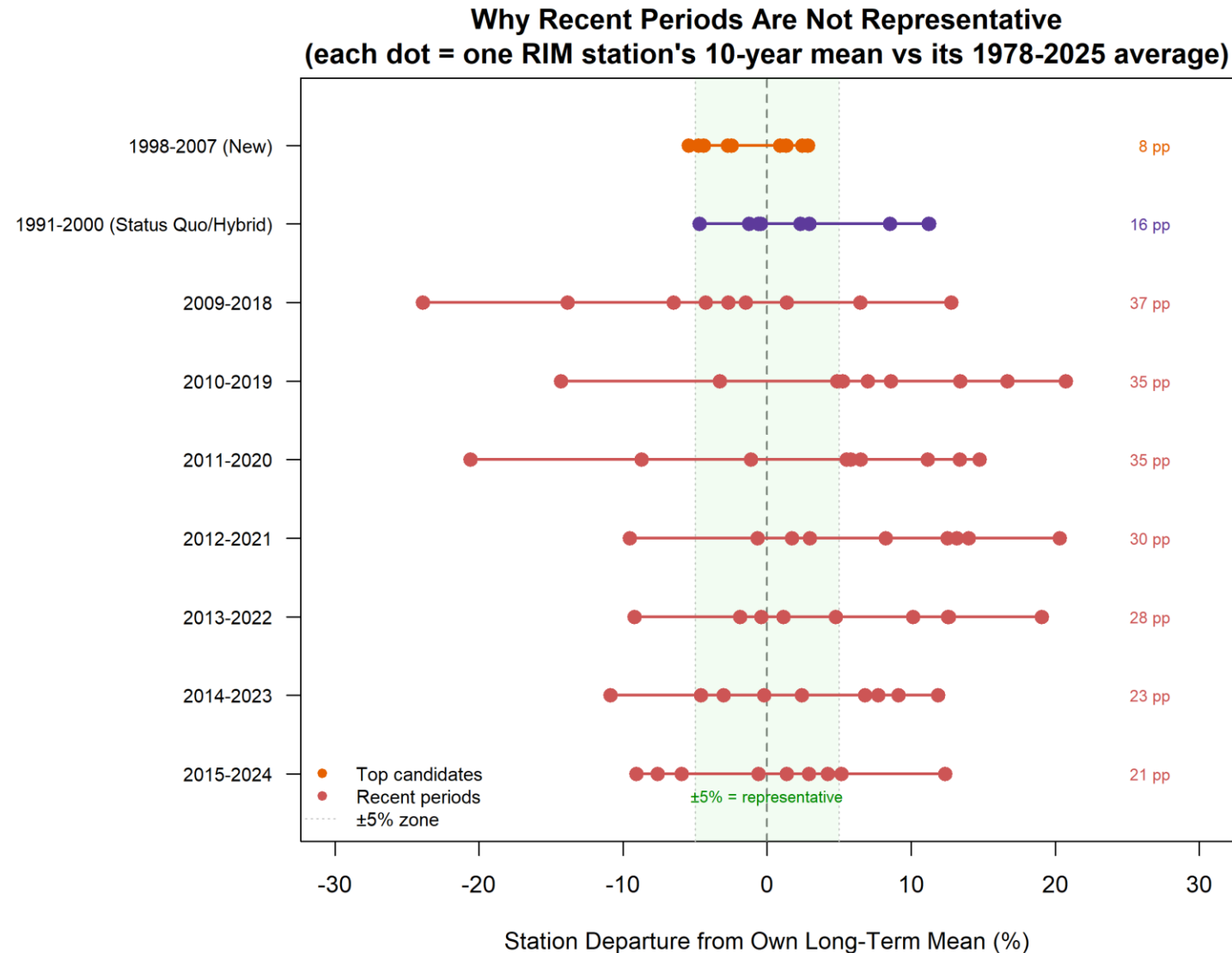


A closer look- station by station departures

This plot represents the mean annual flows of each of the 9 RIM stations in comparison with the reference mean.

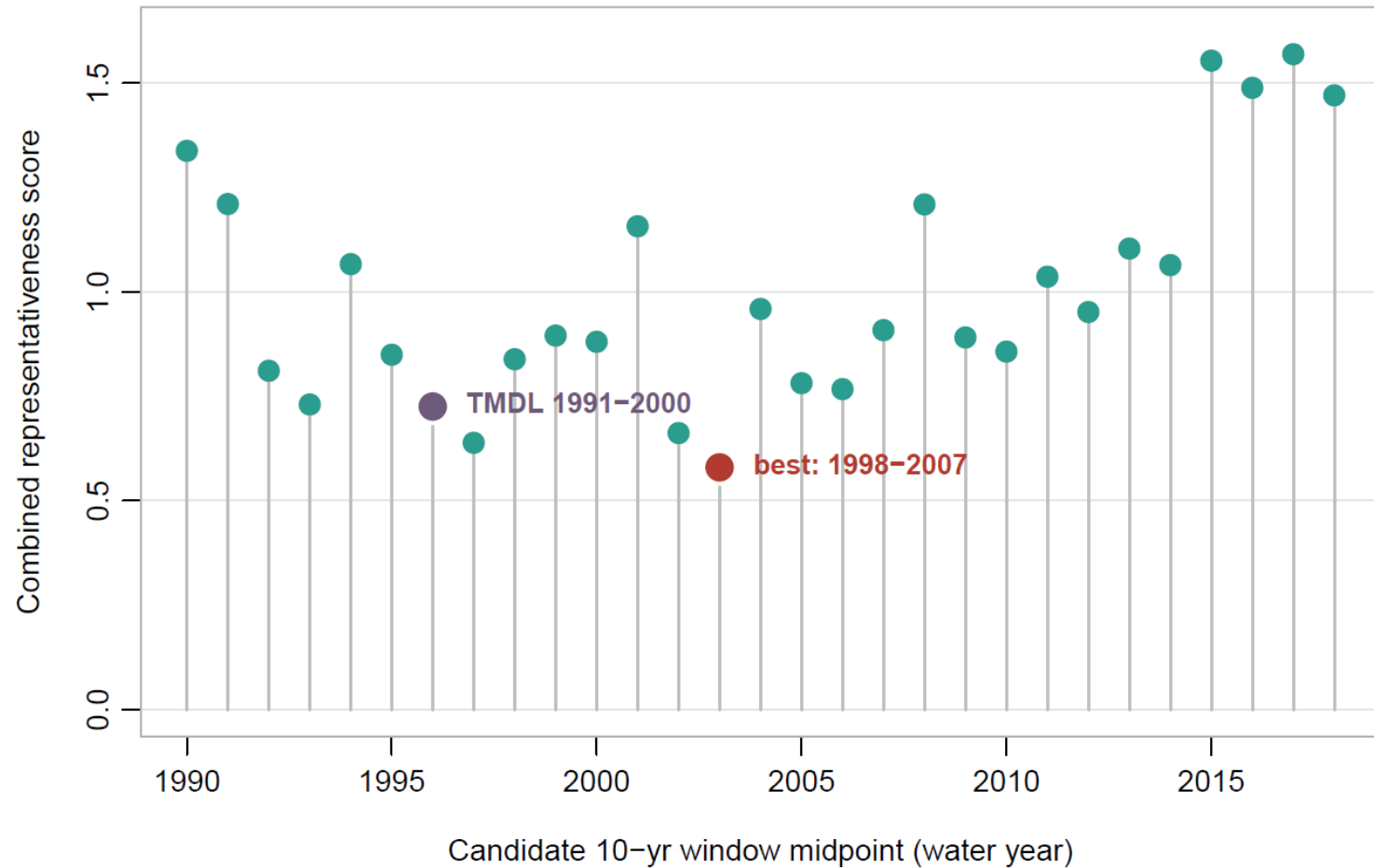
The more recent spans (in red) show more variable responses by watershed

The NEW and STATUS QUO/HYBRID base periods show the most similar response across stations

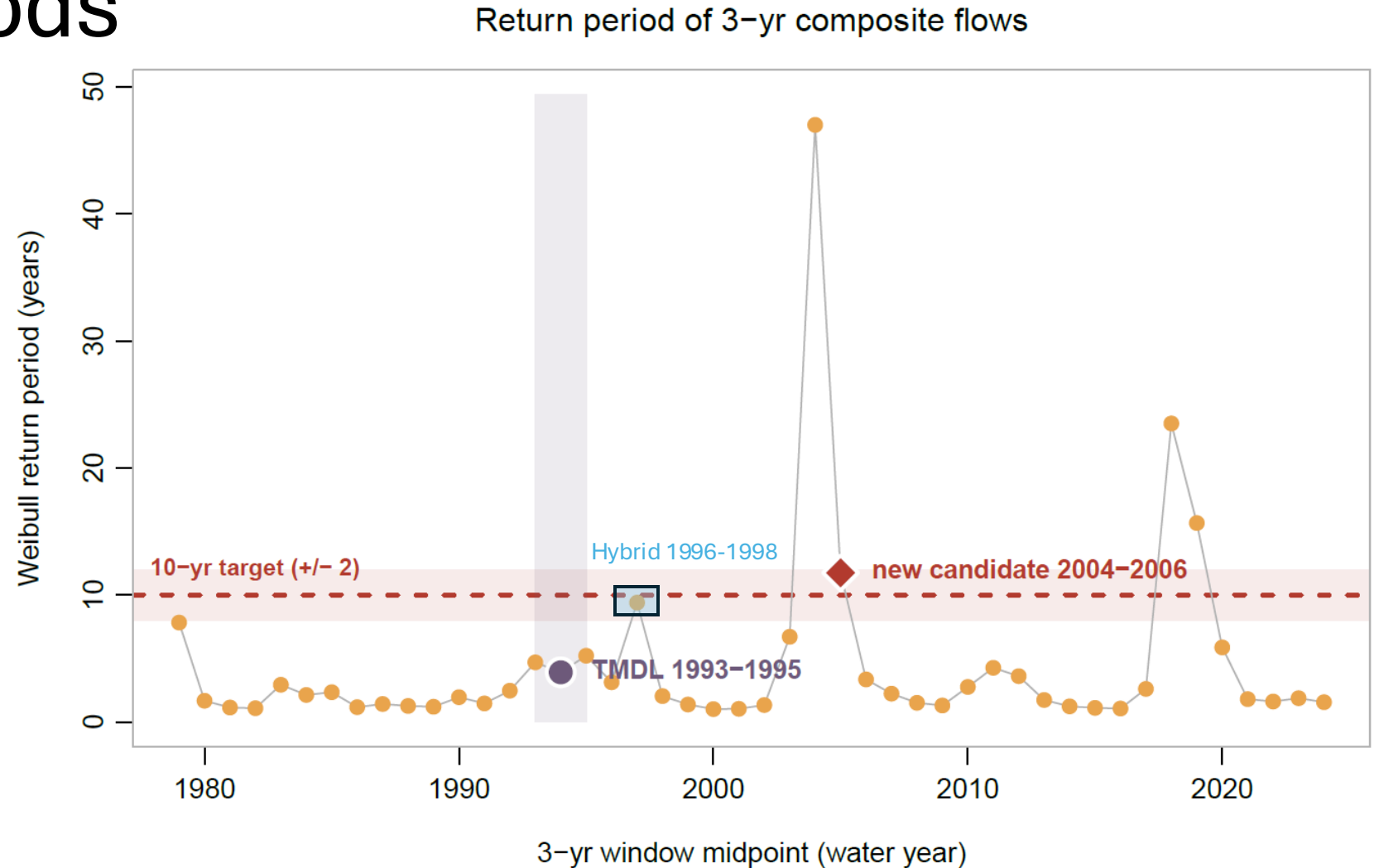


Adding the shape of the distribution: combined score

Base-period candidates: lower = more typical

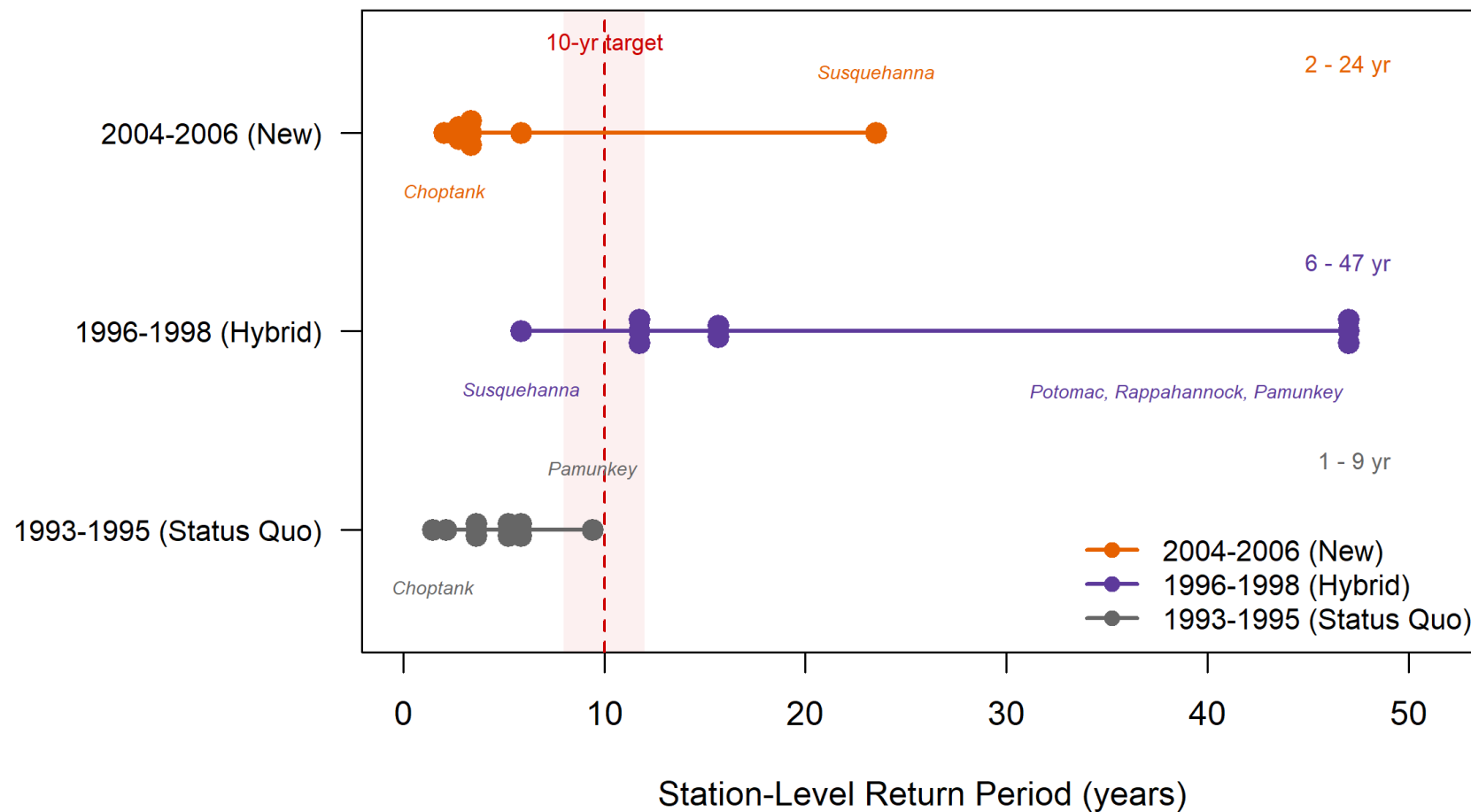


3 year overlapping windows: Average flow return periods



Critical period- individual basin responses

How Extreme is Each Critical Period for Individual Rivers?
(each dot = one RIM station's 3-year flow return period)



Critical period- changes in data and methods.

Full water year versus monthly subsetting

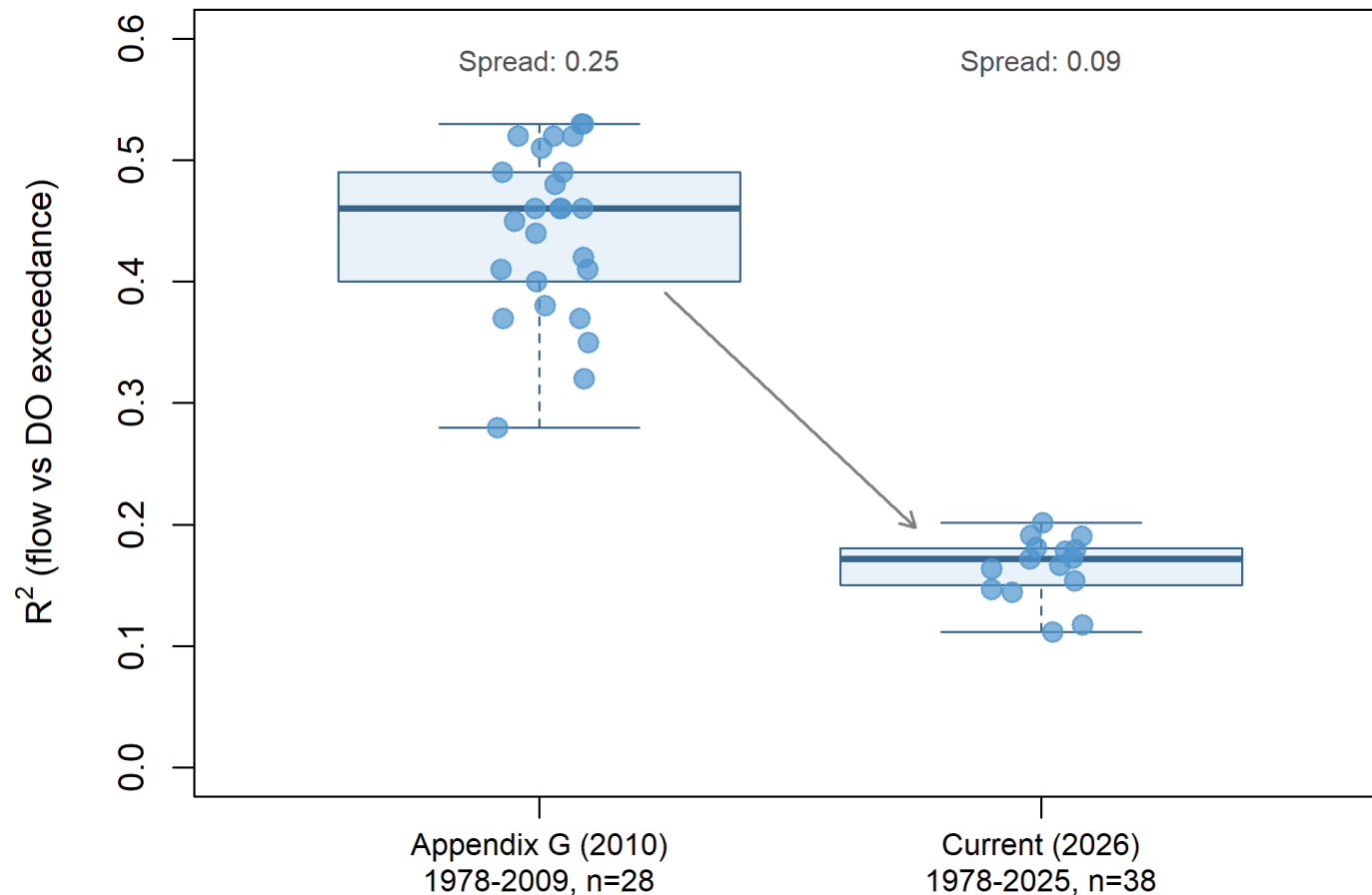
The 2010 TMDL analysis used multiple monthly subsets (for example December to June) instead of the whole water year.

That decision was based on the highly variable correlations between monthly subsets and DO exceedances in the Bay.

Re-running this correlation analysis, we see very little variability across subsets in relation to DO exceedances.

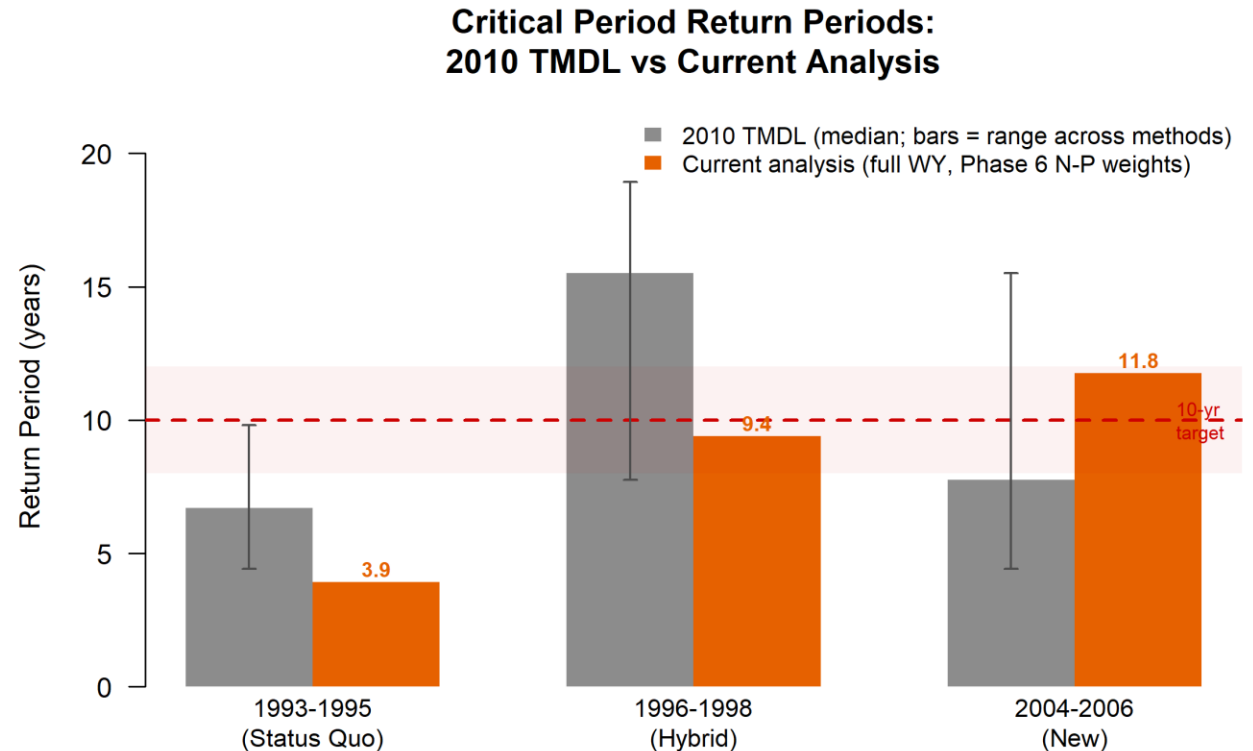
- Monthly subsetting was not necessary given the following:
- New flow data, new N-P weights, new DO Exceedance data, no detrending or record extension necessary.

Monthly Interval Correlations: Previous vs Current Analysis



Critical period- results under different methodologies

- 1993-1995 (Status Quo) falls short of the 10-year target under all methods tested: original and current.
- 1996-1998 (Hybrid) exceeded the target under the old methodology but lands at 9.4 years under current methods: closest to the 10-year goal.
- 2004-2006 (New) meets the target at 11.75 years under current methods.
- Both replacement candidates are scientifically defensible.



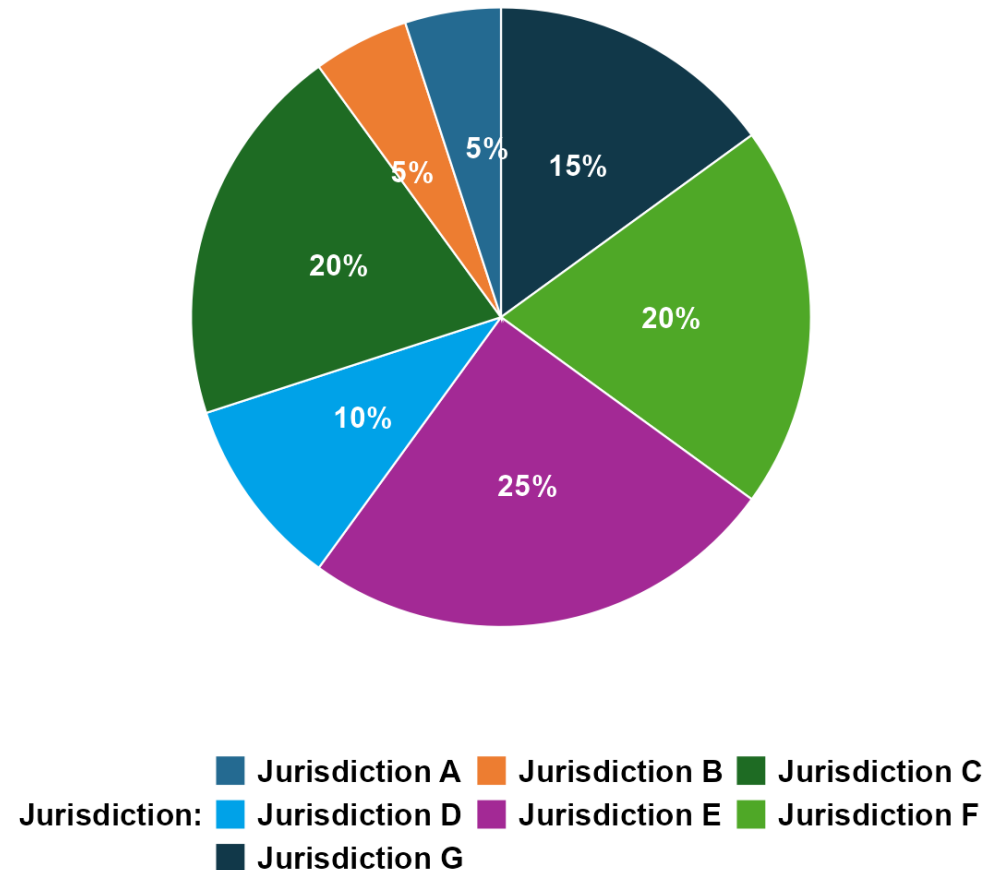


Hydrologic Period

What historical amount of pollutants has each jurisdiction contributed?

- Make sure everyone gets a “fair” piece of pie
 - Look at what each jurisdiction has historically contributed
 - 10-year window
 - Representing typical streamflow and runoff conditions
 - Establish fair, long-term percentage of pollutant loading for everyone

Hypothetical Jurisdiction Share of Load





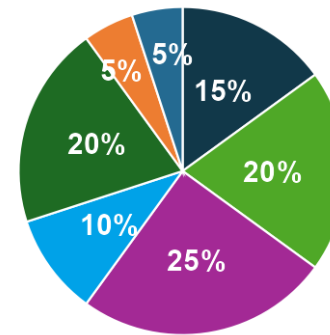
Critical Period

What reductions are needed to meet water quality standards under difficult conditions?

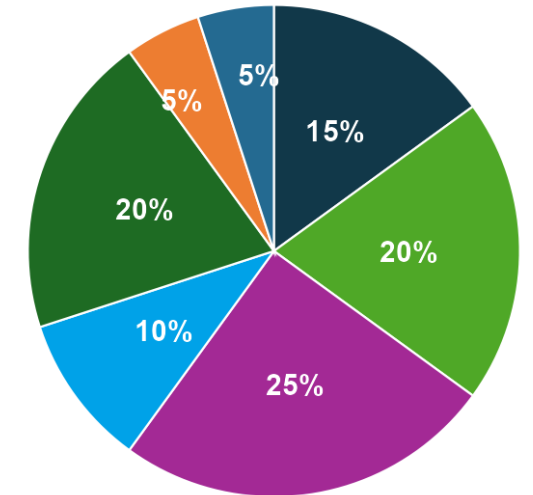
- Determine how big of a pie we must split
 - Calculate how big the pie can be based on the maximum amount of ingredients
 - 3-year window
 - Represents stressful conditions the Bay will experience
 - Used to set pollutant-reduction targets

Hypothetical Jurisdiction Share of Load

Less Extreme Critical Period



More Extreme Critical Period





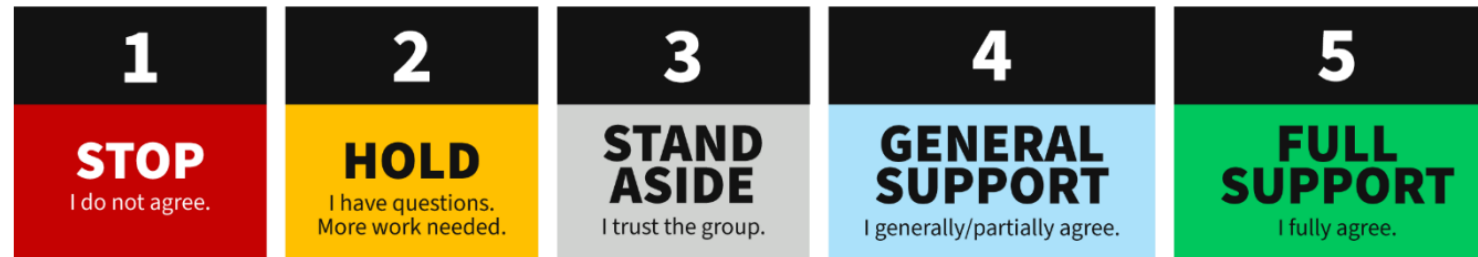
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Decision Requested

After discussion and formulation of a specific proposal, CWGT will be asked to determine which Hydrologic and Critical Periods should be used in the Phase 7 suite of models. The options to be proposed for support are:

- Change the Hydrologic Period to 1998-2007 and Critical Period to 2004-2006
- Keep the existing Hydrologic Period of 1991-2000 and change the Critical period to 1996-1998 (*Note: please see most recent briefing materials for more details on this hybrid option.*)
- Keep the existing Hydrologic Period of 1991-2000 and Critical Period of 1993-1995

Chesapeake Bay Program's Decision-Making Continuum



CONSENT RANGE

The consent range includes Stand Aside, General Support, and Full Support. When all group members fall within this range, consent is reached and implementation may proceed.