Early Bird Forecasts and Analog Year Summary

Early Bird Forecasts or are they called Outlooks – either way, you got to know when to hold them, know when to believe them, know when to walk away and know which areas are favored for more snow and why.

There are lots of late summer/early fall Winter Outlooks being shared and passed around. Recently, it seems there is a race to see who releases the first Outlook. Here's a summary about what I've been watching for a while. See if it helps or share what you watch and works for you.

First don't try to use the early Outlooks to predict snowfall in your backyard or your favorite ski area. There will be time later to fine tune the forecasts. Look at the big picture and trends; look at the watershed or region as a whole. Look for similarities between the Outlooks and what they are illustrating and why.

Some of the Outlooks… Old Farmer's Almanac, Farmer's Almanac, NOAA short & long term, OpenSnow, SnowBrains, your neighbor, my neighbor, Severe Weather Europe, Joe from Colorado, Pete from Oregon, Ron from Idaho, and many more. Some forecasts cost money, while others are free. **Don't believe the first forecast you hear or until you hear the same forecast from 2 or 3 unrelated friends.**

Interesting sidenote from recent study, The Weather Channel was top on list for skillful forecasts. It's good to see Persistence on the list, using today's weather to predict tomorrow. You're only wrong twice when the storm arrives and leaves! I haven't looked in the details of these forecasts - are forecasts for western valleys or mountain weather. If you do, let us know what you learn. Who Produces the Most Skillful Weather Forecasts? From Cliff Mass Weather Blog

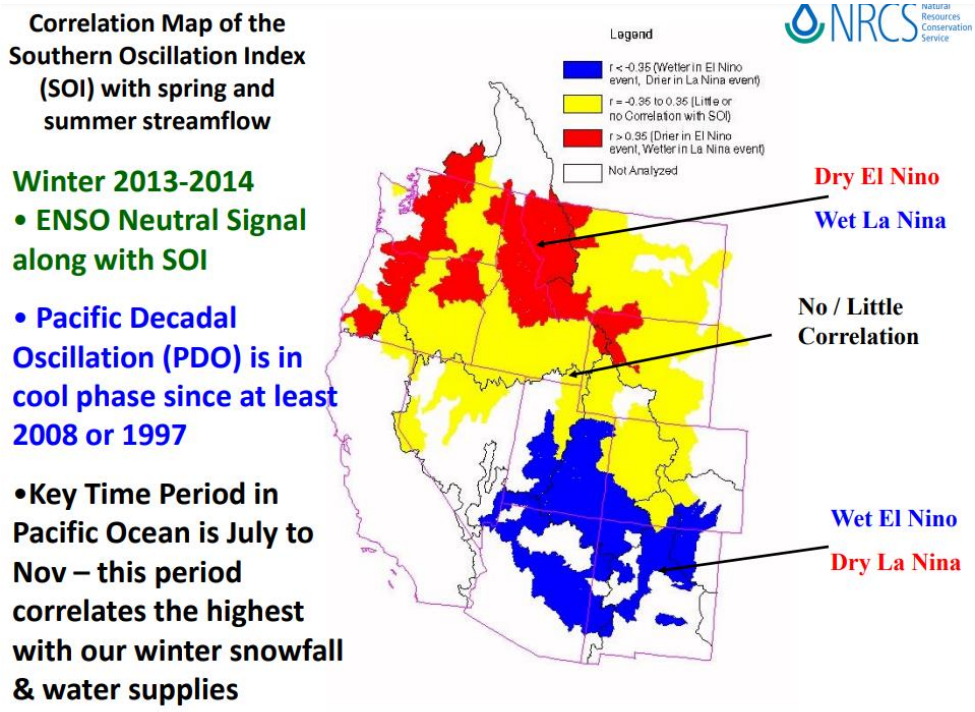
Who remembers the 1982-83 El Nino when inflows to Glen Canyon Dam reached 120 KCFS and outflows reached 92 KCSF. This was the rebirth of El Nino. Prior to '83 you didn't hear much about El Nino, but now hardly a day goes by without mentioning or blaming El Nino for something.

Many Outlooks favor the ENSO weather patterns / relationships. I used this older study to set the stage for many talks.
Variation of SWE and Streamflow in Relation to El Nino/Southern Oscillation

It's an older study but still shows the relationship of La Nina which typically means more winter snow and higher flows in PNW while El Nino means wetter in Desert Southwest, and poor correlation / transition zone across the middle of the West. This study is a correlation between SOI and western rivers driven by winter snowfall. SOI was used instead of sea surface temperatures because of slightly better correlation. The key is the lead time and what happens in the Pacific during the July-November period correlates with spring and summer runoff in the western US.

The key to future prediction is if these past correlations can still be used with increasing air temperatures and greater degree of climate variability. See link to Pete Parsons Outlooks below and slide that shows global temperatures increasing. The NRCS and NWS may not be using ENSO as a predictive streamflow variable anymore, but they are still sharing snow and ENSO correlations.

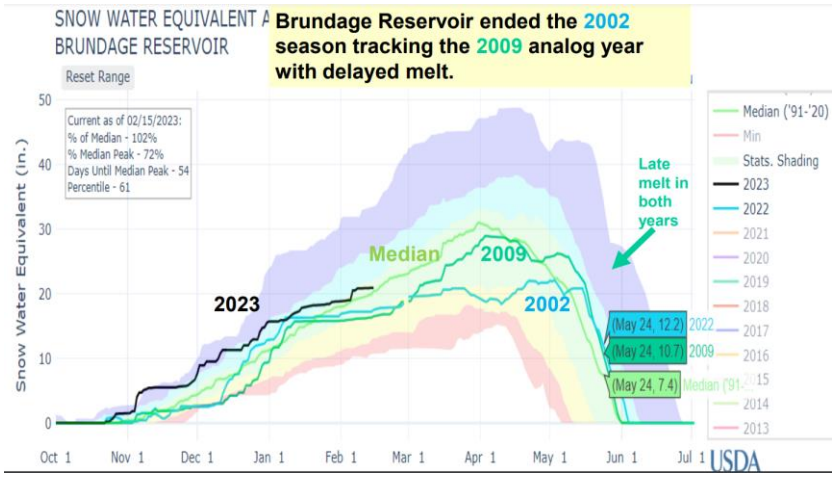
Here's a slide illustrating the SOI correlation with western rivers. Full report and table of river correlations is at bottom. This slide helps to explain the general pattern seen in many of the Outlooks mentioned above. Cool and wet in PNW in La Nina years and across Deseret Southwest in El Nino years. Today's Outlooks go into much more detail by looking at winter temperatures and precipitation.

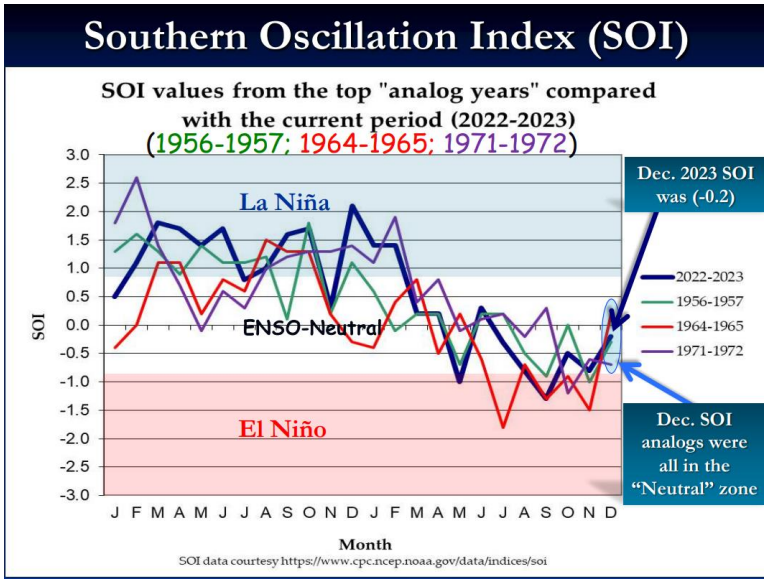


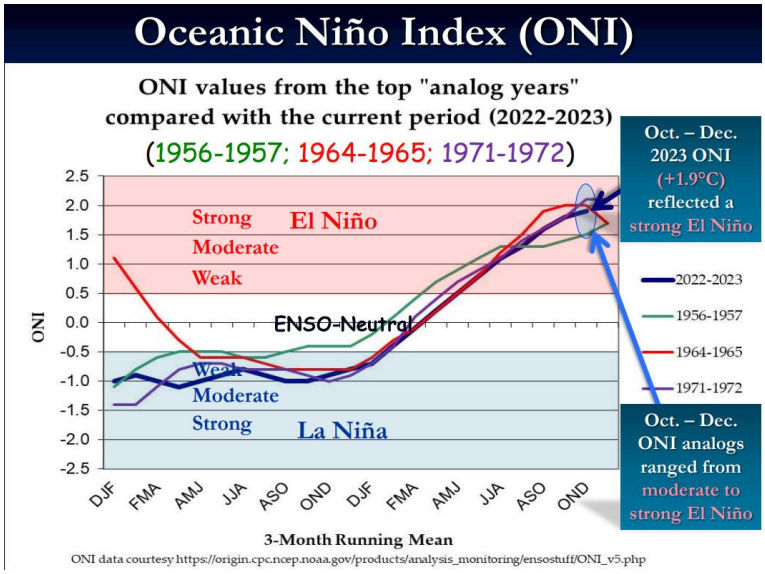
A few years back, Pete Parson collaborated with Jan Curtis, retired NRCS Climatologist (and maybe the last NRCS Climatologist) to review the best climate teleconnections to produce an Outlook for coming season. Pete keeps it simple and uses three primary indexes: SOI - Southern Oscillation Index, ONI - Oceanic Nino Index, and PDO - Pacific Decadal Oscillation. Link to his Seasonal Climate Forecasts page that I watch and wait patiently for its mid-month release. Link to January 18, 2024 Seasonal Climate Forecast with analog years based these indexes and index images below.

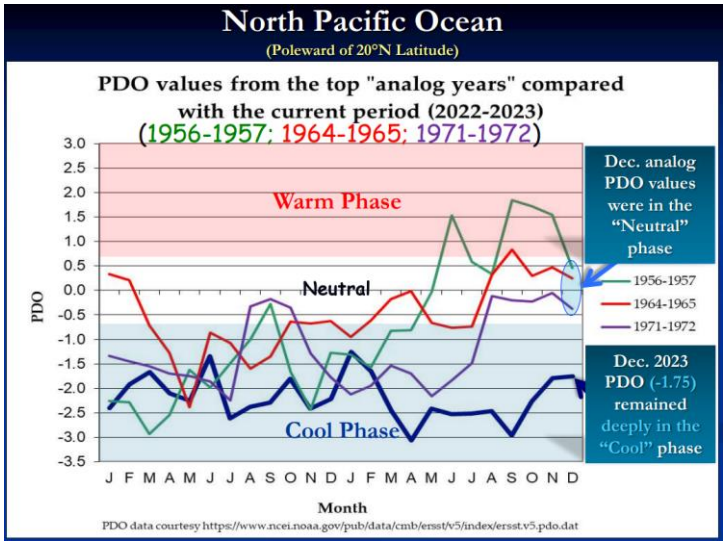
Analog years become these water years:
1956-57 is water year 1958
1964-65 is water year 1966
1971-72 is water year 1973

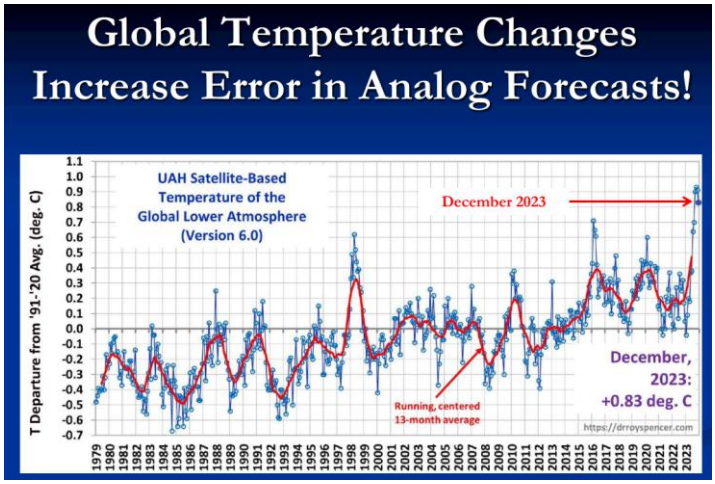
If we take the analog years a step farther, we can look at snow accumulation for current and analog years. Pete nailed it in 2022 by using 2009 as the analog year. Both years had a major mid-winter dry spell followed by a delay melt and wet spring. For a more detailed comparison on how these analog years worked, see Brundage SWE graph below and Review of La Nina Analog Years


SNOW WATER EQUIVALENT A
BRUNDAGE RESERVOIR
Brundage Reservoir ended the 2002 season tracking the 2009 analog year with delayed melt.
Reset Range
Current as of 02/15/2023:
% of Median - 102%
% Median Peak - 72%
Days Until Median Peak - 54
Percentile - 61
Snow Water Equivalent (in.)
Late melt in both years
Median
2009
2002
2023
(May 24, 12.2) 2022
(May 24, 10.7) 2009
(May 24, 7.4) Median ('91-
Median ('91-'20)
Min
Stats. Shading
2023
2022
2021
2020
2019
2018
2017
2016
2015
2014
2013
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
USDA

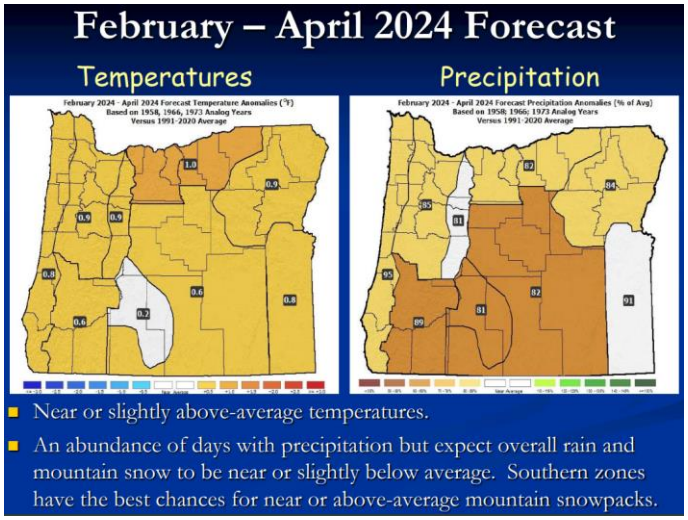

Southern Oscillation Index (SOI)
SOI values from the top "analog years" compared with the current period (2022-2023)
(1956-1957; 1964-1965; 1971-1972)
La Niña
ENSO-Neutral
El Niño
SOI
Dec. 2023 SOI was (-0.2)
2022-2023
1956-1957
1964-1965
1971-1972
Dec. SOI analogs were all in the "Neutral" zone
J F M A M J J A S O N D J F M A M J J A S O N D
Month
SOI data courtesy https://www.cpc.ncep.noaa.gov/data/indices/soi


Oceanic Niño Index (ONI)
ONI values from the top "analog years" compared with the current period (2022-2023)
(1956-1957; 1964-1965; 1971-1972)
Strong
Moderate
Weak
El Niño
ENSO-Neutral
Weak
Moderate
Strong
La Niña
ONI
Oct. – Dec. 2023 ONI (+1.9°C) reflected a strong El Niño
2022-2023
1956-1957
1964-1965
1971-1972
Oct. – Dec. ONI analogs ranged from moderate to strong El Niño
DJF FMA AMJ JJA ASO OND DJF FMA AMJ JJA ASO OND
3-Month Running Mean
ONI data courtesy https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php





Use of analog years to produce monthly temp & precip forecasts.



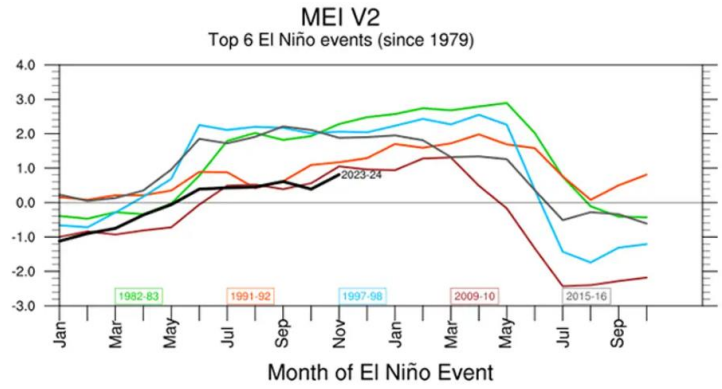
Another analysis shows this year's El Nino initially was tracking 2009-10 El Nino winter. Next up SWE plots of these analog years and this year to see similarities or not.

https://weather.com/news/climate/news/2023-12-14-super-el-nino-chances-december-noaa-update?cm_ven=dnt_social_facebook&sf184810746=1

And there are indications this strong El Niño may be behaving like 2009-10, at least initially.

Scientists use a variable called the multivariate ENSO index, or MEI, to not only capture water temperatures, but also how *the atmosphere responds* to the ocean water.

And when you plot that index, as done in the graph below, this strong El Niño's response in the atmosphere is closer to 2009-10 than to the previous super El Niños such as 2015-16, 1997-98 or 1982-83. That was also noted in the large-scale pattern of rising and sinking air in the atmosphere differing this El Niño compared to others, by New Zealand-based meteorologist Ben Noll.



This graph shows the time series of the MEI plotted for the strongest six El Niño events. The current El Niño is shown by the black line.
(NOAA/PSL)

Southern Oscillation Index Statistical Correlation with
Spring Runoff in the Western US

Natural Resources Conservation Service
National Water and Climate Center
October 15, 1997

Background:
The USDA, NRCS National Water and Climate Center (NWCC) has completed an analysis of the correlation of the Southern Oscillation Index (SOI) with spring and summer volume runoff in the western U.S. The results are shown in Figure 1 and Table 1 attached. Basins with a significant correlation (greater than 0.35 or less than -0.35), may require additional monitoring and analysis during Water Year 1998 depending on specific water management needs.

What is El Nino/Southern Oscillation (ENSO)?
"ENSO" stands for "El Nino / Southern Oscillation". The acronym arose in the climate research community, and reflects an attention bias toward the warm phase of the entire cycle. El Nino is just one phase of an irregular fluctuation between warmer than usual and colder than usual ocean temperatures in the Eastern Pacific. The cold phase has recently come to be known as "La Nina". The El Nino/La Nina "cycle" does not occur with strict periodicity. Historically, an El Nino usually recurs every 3-7 years, as does its (cold) La Nina counterpart.

The overlying atmosphere is tightly coupled to ocean temperatures and circulation patterns. An atmospheric pressure signal is seen throughout the tropics that is strongly linked to El Nino and La Nina. When barometric pressure is higher than usual in the western Pacific near Indonesia, pressure is lower than usual in the subtropical Pacific near Easter Island and Tahiti. This global-scale pressure signal, identified 70 years ago, is known as the "Southern Oscillation." Surface barometric pressure at Darwin, Australia and the island of Tahiti are strongly anti-correlated: when one is higher than usual, the other is lower than usual. The difference, Tahiti minus Darwin, suitably normalized, is referred to as the Southern Oscillation Index (SOI), and is frequently used as a convenient, simple and reasonably accurate tool to monitor the status of El Nino/La Nina.

Because more attention has been devoted to El Nino, and noting the association between the Southern Oscillation in the atmosphere and El Nino (and La Nina) in the ocean, the research community began to refer to the combination as ENSO (El Nino/Southern Oscillation). This moniker is somewhat asymmetric: El Nino pertains to just one of the two phases of the Southern Oscillation. It would be perhaps more accurate to refer to El Nino as the warm phase of the Southern Oscillation, and to La Nina as the cold phase of the Southern Oscillation. The term "ENSO" is, however, firmly engrained.

Data Sources:
Southern Oscillation Index values were obtained from the NOAA Climate Prediction Center at their Internet address http://nic.fb4.noaa.gov/data/cddb/cddb/soi [from the second table labeled ”Standardized Data, Sea Level Pressure, (Standard Tahiti - Standard Darwin)”] available from water year 1951 to September 1997. Streamflow volumes were obtained from the NWCC Centralized Forecast System, from water years 1951 - 1997.

Calculation Methodology and Results:
Single and multiple month (summed) SOIs were correlated with spring streamflow volumes at key basin streamflow points. Representative streamflow points, flow periods analyzed, and SOI-streamflow correlation values are shown in Table 1. The values given are for the SOI period (sequence of months) that gave the highest correlation with streamflow. The table contains only those basins that have a correlation greater than 0.35 or less than -0.35.

General Interpretation:
Figure 1 summarizes the results graphically. River basins with correlations greater than 0.35 are shown in red, basins with correlations less than -0.35 in blue, basins with little or no SOI-spring runoff correlation are shown in yellow, and the white indicates areas not analyzed and/or streams that are not water supply forecast points.

Basins with correlations less than -0.35 (blue) tend to have higher than average streamflow during El Nino years (when the SOI is negative, as it is now), and lower than average streamflow during La Nina (when the SOI is positive). Basins with correlations greater than 0.35 (red) tend to exhibit lower than average streamflow during El Nino years and higher than average streamflow during La Nina. Basins with significant SOI correlations (blue and red areas) will require further monitoring as the water year progresses.

For More Information:

Please contact the Water and Climate Services Team at the NWCC located at http://www.wcc.nrcs.usda.gov or send an e-mail to info@wcc.nrcs.usda.gov. ENSO description courtesy of Kelly Redmond, Regional Climatologist, Western Regional Climate Center http://www.wrcc.sage.dri.edu/enso.

Figure 1. Correlation of the Southern Oscillation Index (SOI) with spring and summer volume runoff

Table 1. Representative basins with significant SOI-Spring/Summer Runoff correlation.

STATE/BASIN	RUNOFF PERIOD	SOI PERIOD	CORRELATION
ARIZONA			
Gila	Jan-May	Oct-Dec	-0.49
Salt	Jan-May	Oct-Dec	-0.49
COLORADO			
Purgatoire	Apr-Sep	Oct-Dec	-0.58
Dolores	Apr-Jul	Oct-Dec	-0.41
Animas	Apr-Jul	Oct-Dec	-0.36
IDAHO			
St. Joe at Calder	Apr-Jul	Sep-Dec	0.56
NF Clearwater (Dworshak Res	Apr-Jul	Jul-Dec	0.67
Salmon at Salmon	Apr-Jul	Aug-Sep	0.40
MONTANA			
Fisher nr. Libby	Apr-Jul	Apr-Sep	0.67
Lower Willow Inflow	Apr-Jul	Apr-Sep	0.61
Blackfoot nr Bonner	Apr-Jul	Apr-Sep	0.58
Bitterroot at Darby	Apr-Jul	Aug-Sep	0.58
Clarks Fork nr. Belfry	Apr-Jul	Aug-Sep	0.52
Hungry Horse Inflow	Apr-Jul	Apr-Sep	0.50
Swan River nr. Bigfork	Apr-Jul	Aug-Sep	0.50
Yellowstone at Corwin Spgs.	Apr-Jul	Aug-Sep	0.49
Big Hole River nr. Melrose	Apr-Jul	Aug-Sep	0.48
Boulder nr. Big Timber	Apr-Jul	Aug-Sep	0.47
Yaak River nr. Troy	Apr-Jul	Apr-Sep	0.42
Marias nr. Shelby	Apr-Jul	Jul	0.40
St. Mary nr. Babb	Apr-Jul	Apr-Sep	0.38
Madison nr. Grayling	Apr-Jul	Aug-Sep	0.37
Missouri at Toston	Apr-Jul	Apr-Sep	0.36
Clark Fork abv. Missoula	Apr-Jul	Apr-Sep	0.35
NEW MEXICO			
Pecos	Mar-Jul	Oct-Jan	-0.52
Zuni	Jan-May	Oct-Dec	-0.46
Rio Hondo	Mar-Jul	Oct-Dec	-0.45
Rio Chama	Mar-Jul	Oct-Nov	-0.41
Lower Rio Grande	Mar-Jul	Oct-Dec	-0.38
Canadian	Mar-Jun	Nov-Jan	-0.37
OREGON			
Rogue River @ Grants Pass	Apr-Jul	Sep	0.46
North Umpqua @ Winchester	Apr-Jul	Sep	0.43
NF John Day at Monument	Apr-Jul	May-Sep	0.36
Little Deschutes near LaPine	Apr-Jul	Sep-Dec	0.36
Blue Lake Inflow	Apr-Jul	Oct-Dec	0.57
UTAH			
Sevier River @ Hatch	Apr-Jul	Oct-Jan	-0.60
Virgin	Apr-Jul	Oct-Dec	-0.56
Minersville Reservoir Inflow	Apr-Jul	Oct-Jan	-0.56
Recapture Creek	Mar-Jul	Sep-Nov	-0.55
Beaver River near Beaver	Apr-Jul	Oct-Dec	-0.48
Vernon Creek near Vernon	Apr-Jul	Oct-Nov	-0.46
Duchesne	Apr-Jul	Nov-Dec	-0.45
Muddy Creek	Apr-Jul	Oct-Nov	-0.39
Cottonwood Creek	Apr-Jul	Oct-Dec	-0.37
WASHINGTON			
Yakima at Cle Elum	Apr-Jul	Sep-Dec	0.53
Skagit at Newhalem	Apr-Jul	Jun-Oct	0.49
Chelan at Chelan	Apr-Jul	Jun-Oct	0.47
WYOMING			
Wind River nr Dubois	Apr-Jul	Aug-Sep	0.53
Snake above Palisades	Apr-Jul	Jun-Sep	0.48
Buffalo Bill Resv Inflow	Apr-Jul	Aug-Sep	0.44
Boysen Reservoir Inflow	Apr-Jul	Aug-Sep	0.36