Humboldt River Basin Snow Survey Program Overview and 2016 Water Supply Conditions

Humboldt River Basin Water Authority Meeting
Winnemucca, Nevada
May 13, 2016

Jeff Anderson
USDA-NRCS
Snow Survey / Water Supply Forecasting Program
Reno, NV

United States Department of Agriculture
Natural Resources Conservation Service

Outline

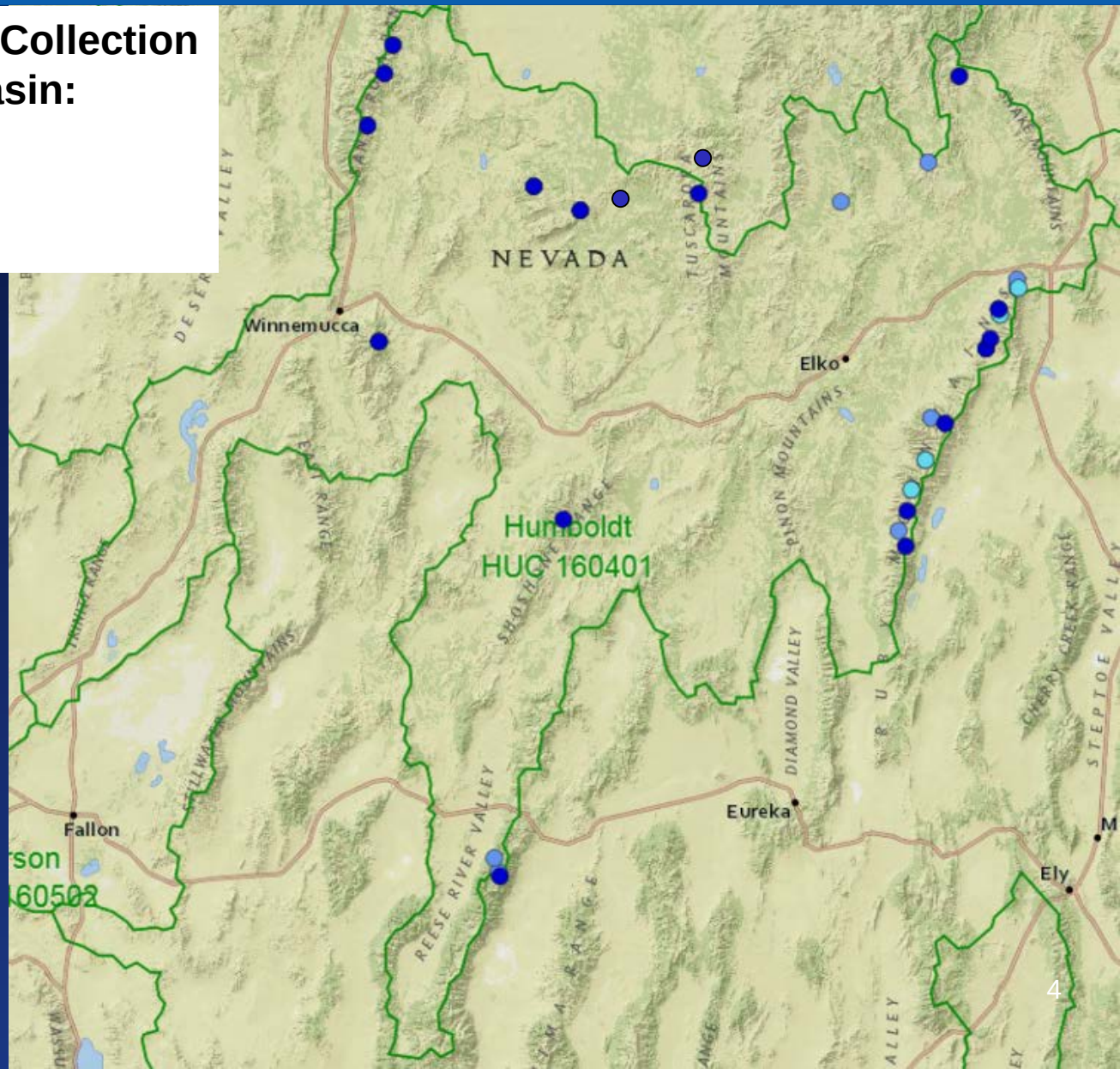
- Overview of data collection network
- Snow and precipitation summary
- Water supply and streamflow forecasts

Snow Water Equivalent (SWE) is the amount of **water** contained within the snowpack. It can be thought of as the depth of **water** that would theoretically result if you melted the entire snowpack instantaneously.

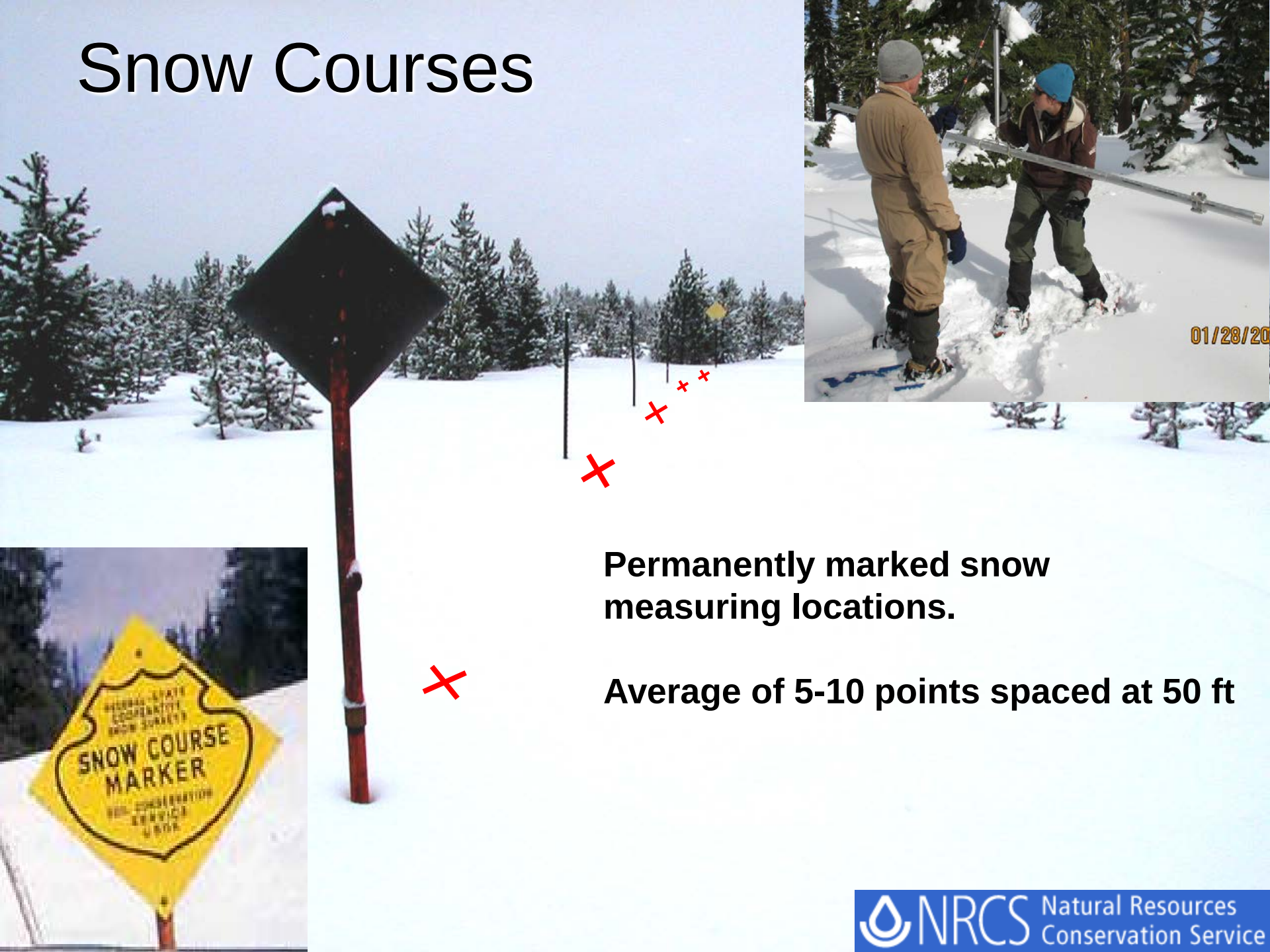
Snow Depth (in) * Density = SWE (in)

Overview of NRCS Data Collection Network in Humboldt Basin:

22 automated stations
10 manual snow courses



Snow Courses

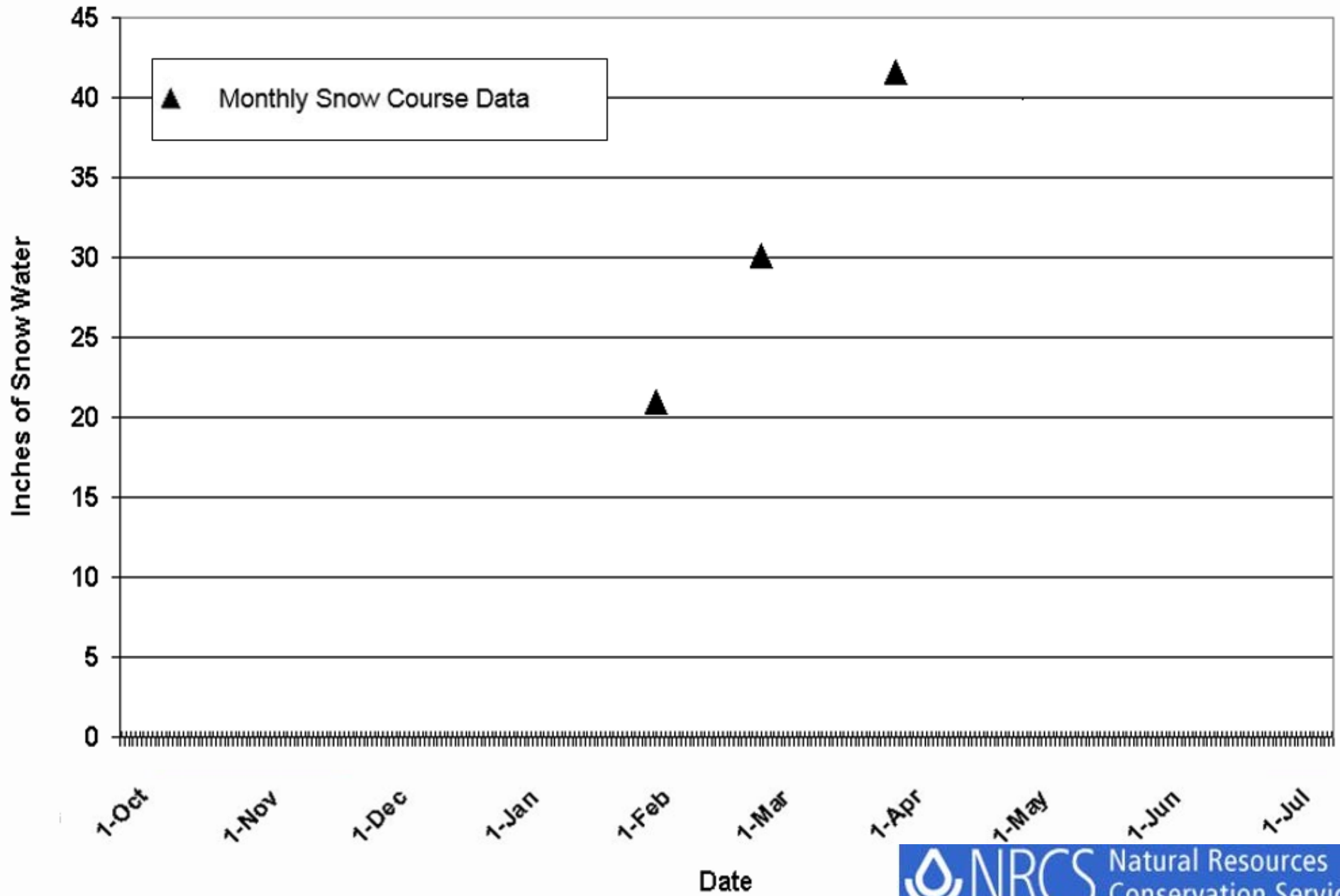


Permanently marked snow measuring locations.

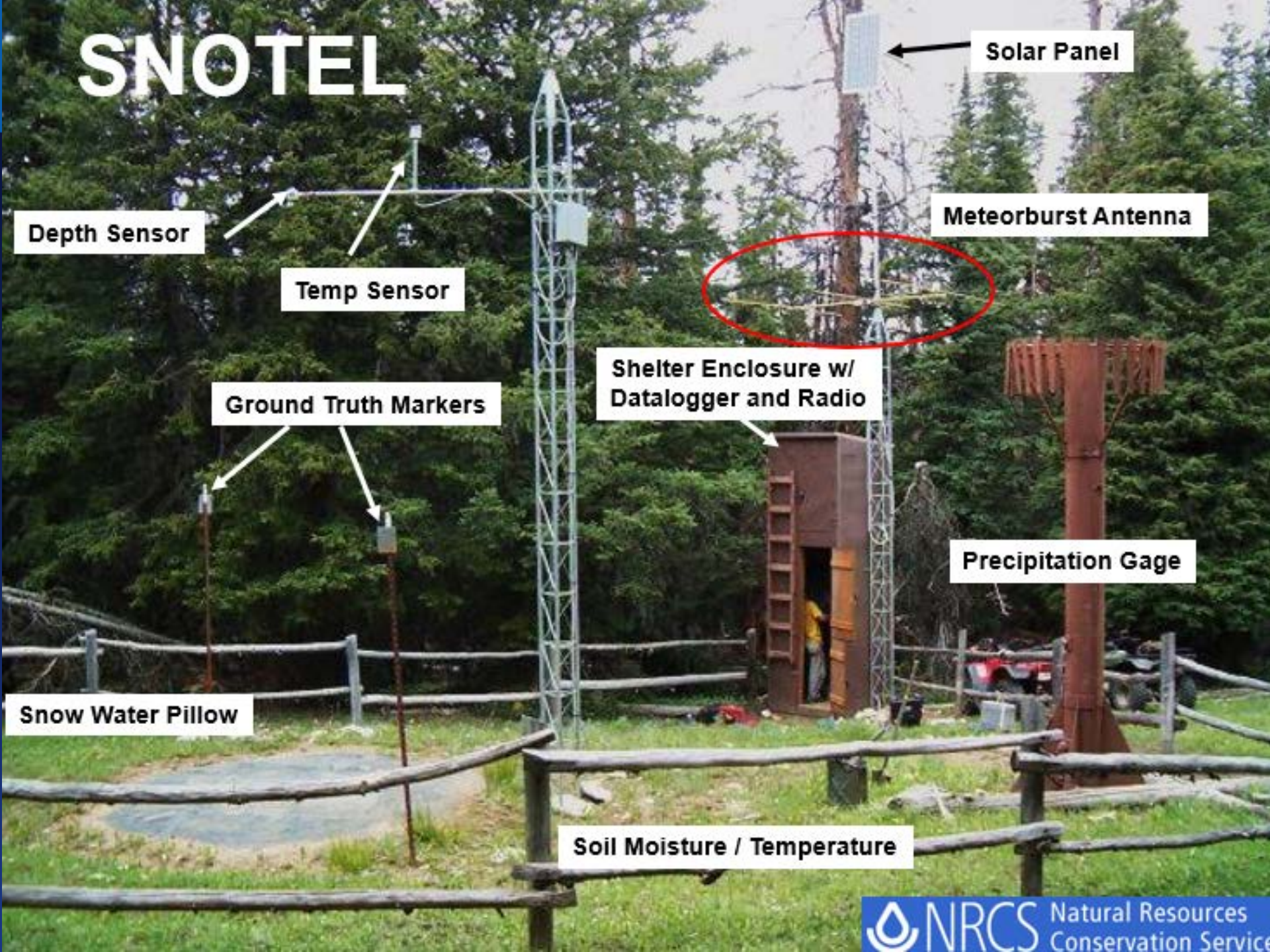
Average of 5-10 points spaced at 50 ft

NRCS Natural Resources Conservation Service

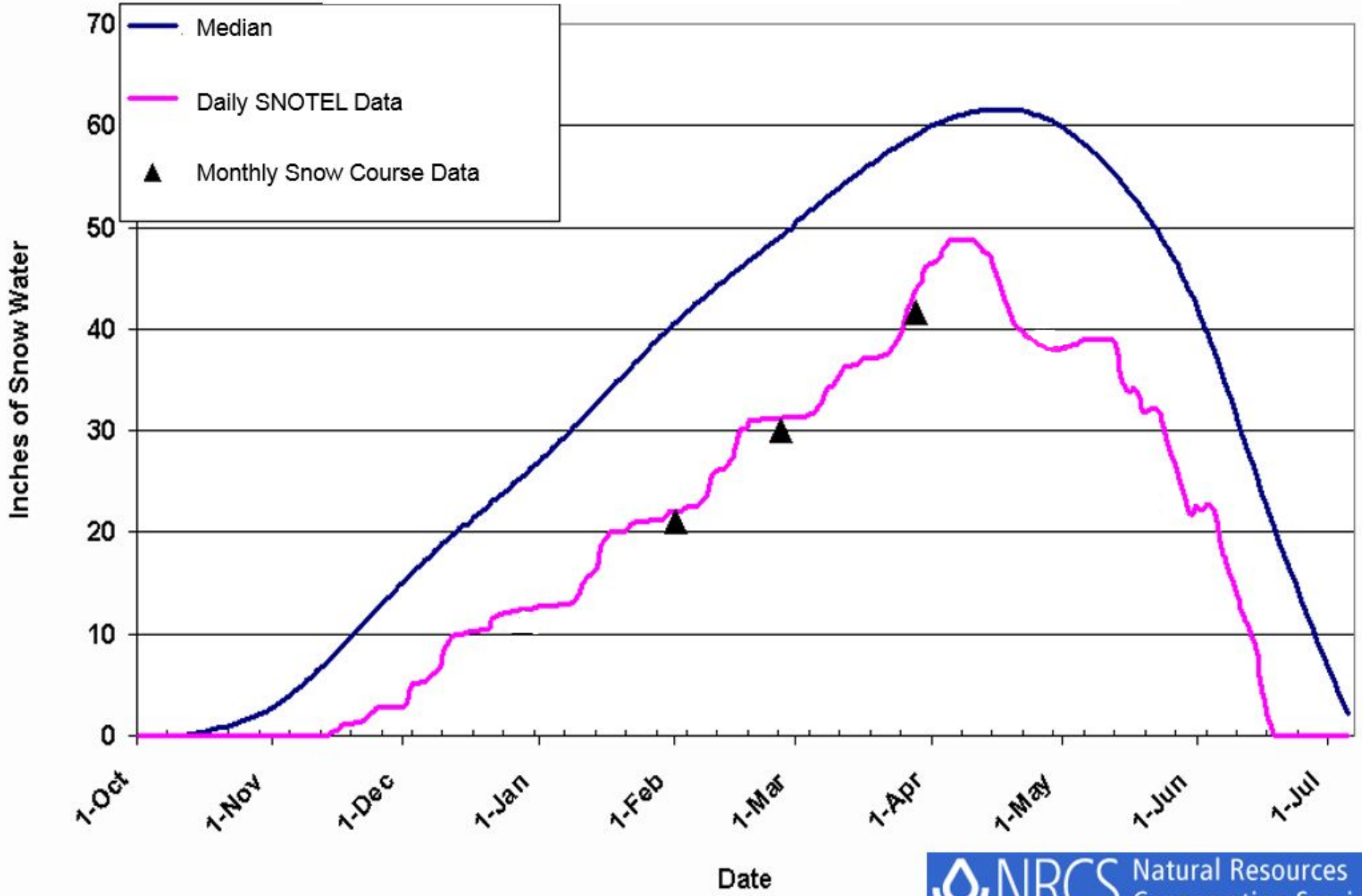
Snow Course Monthly Data



NRCS Natural Resources Conservation Service


SNOTEL
Solar Panel
Depth Sensor
Temp Sensor
Meteorburst Antenna
Shelter Enclosure w/
Datalogger and Radio
Ground Truth Markers
Precipitation Gage
Snow Water Pillow
Soil Moisture / Temperature
NRCS Natural Resources
Conservation Servic

SNOTEL daily data vs Snow Course Monthly Data



NRCS Natural Resources Conservation Service

New SNOTELs

Fry Canyon - 2014
Independence Range – NF Humboldt R

Dry Creek – 2013
East Humboldt Range – Secret Ck

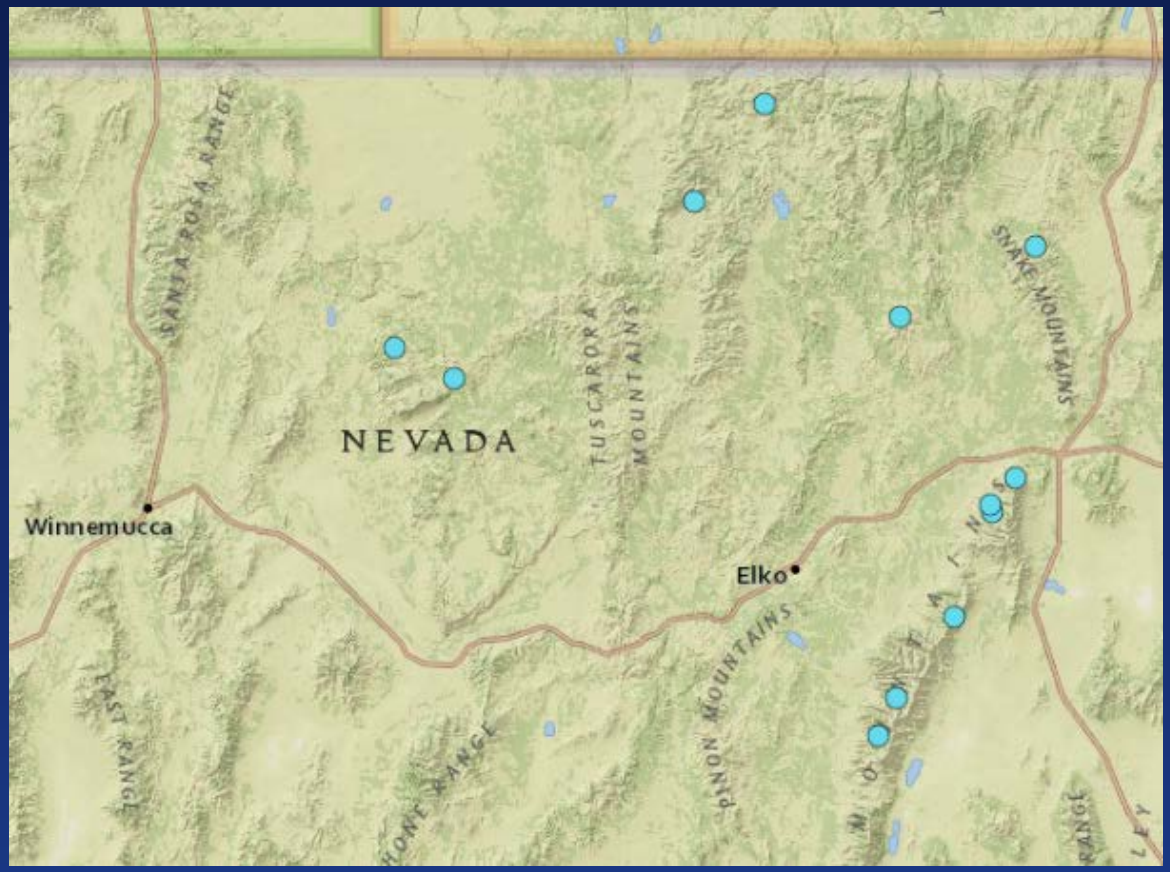
Golconda – 2011
Sonoma Range – Lower Humboldt R

Toe Jam – 2009
Tuscarora Range – Rock Ck

Hole-in-Mountain SNOTEL hit by Avalanche!

SnoLites (Automated Aerial Markers)

- 12 SnoLites installed in Humboldt Basin 2012-2013 with snow depth, temperature, and satellite modem, provide 6 hour data.
- Allowed for discontinuing Elko helicopter snow survey flights



2014 Upgraded SnoLites

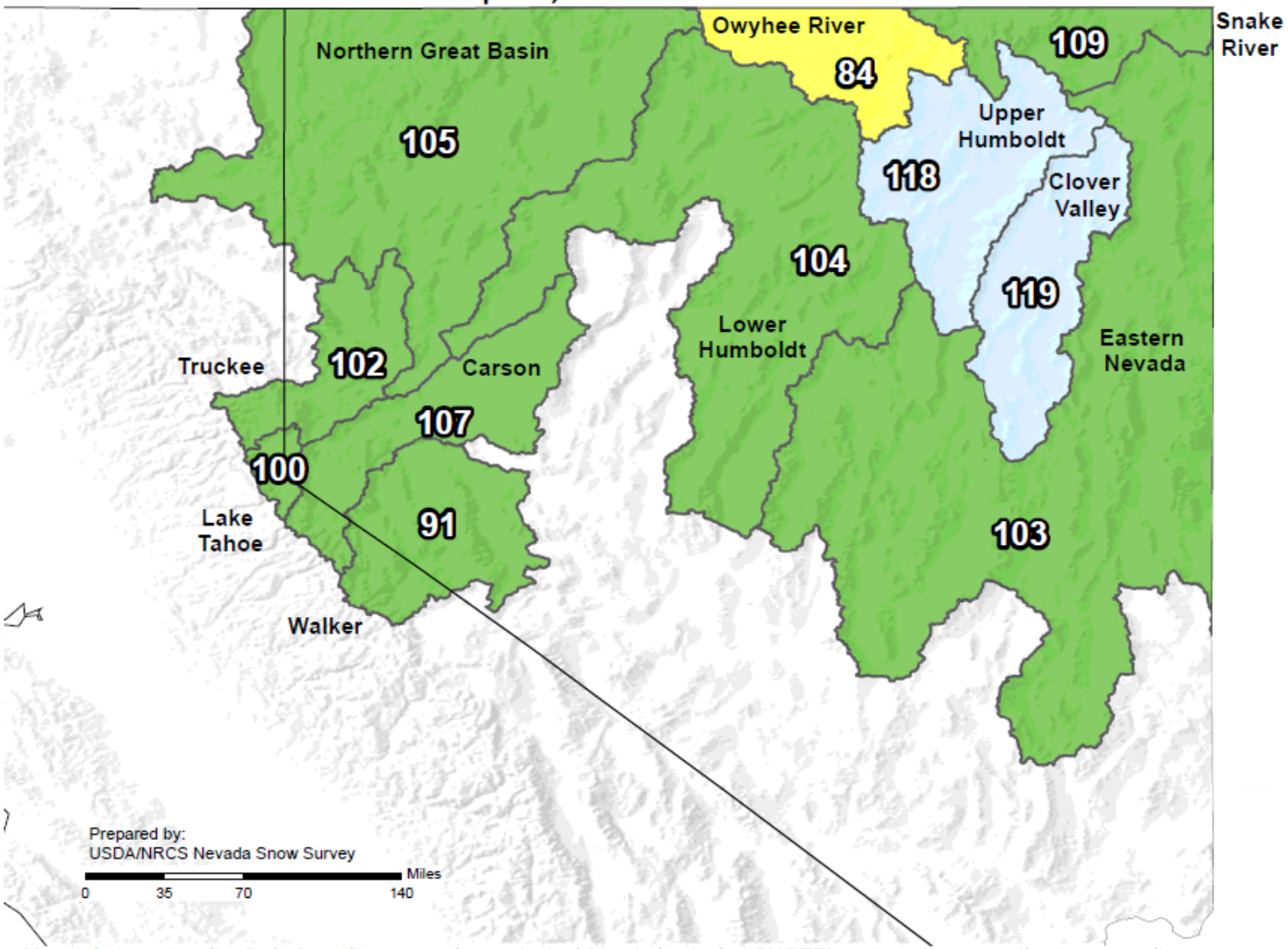
Added precipitation gage & soil moisture

- Columbia Basin
- Jakes Creek
- Merritt Mtn
- Midas
- Stag Mountain
- Snowstorm Mtn
- Tent Mtn Lower

Snow and Precipitation Summary

2 feet of snow

Nevada & Eastern Sierra
Percent of Median Snowpack
April 1, 2016

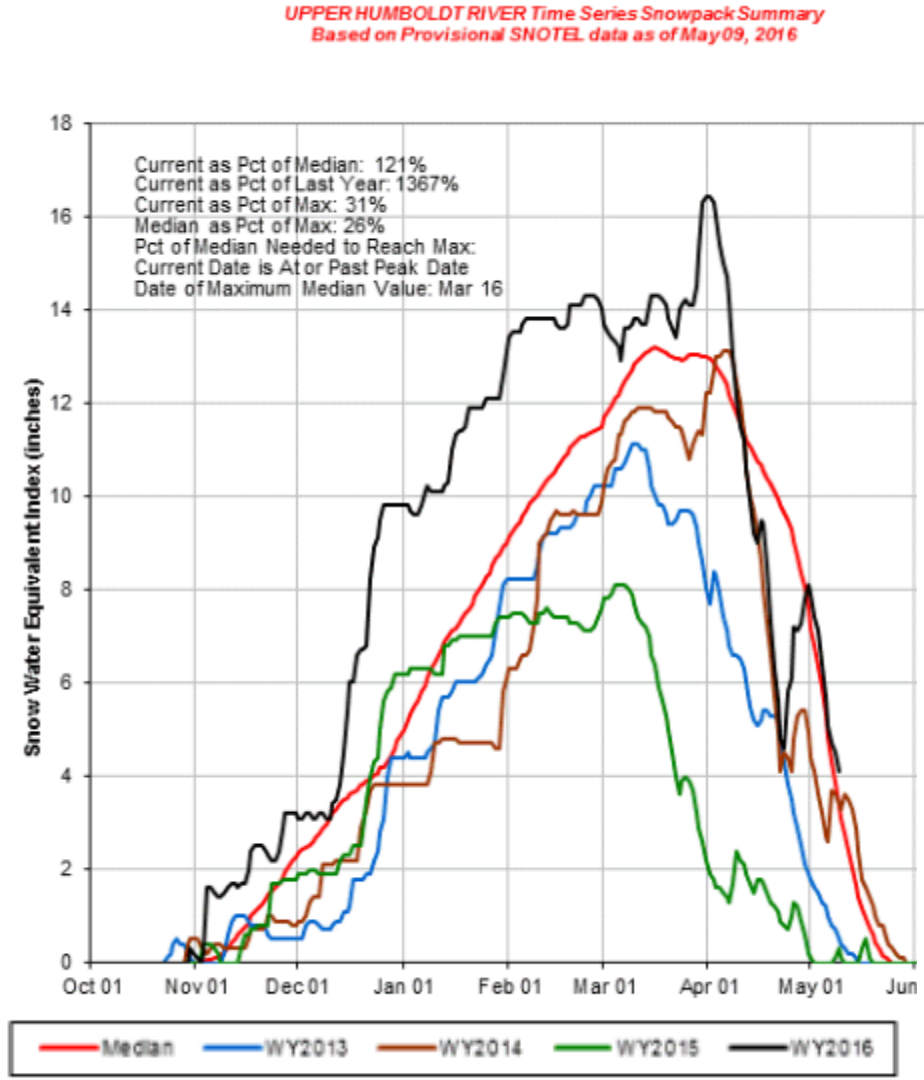


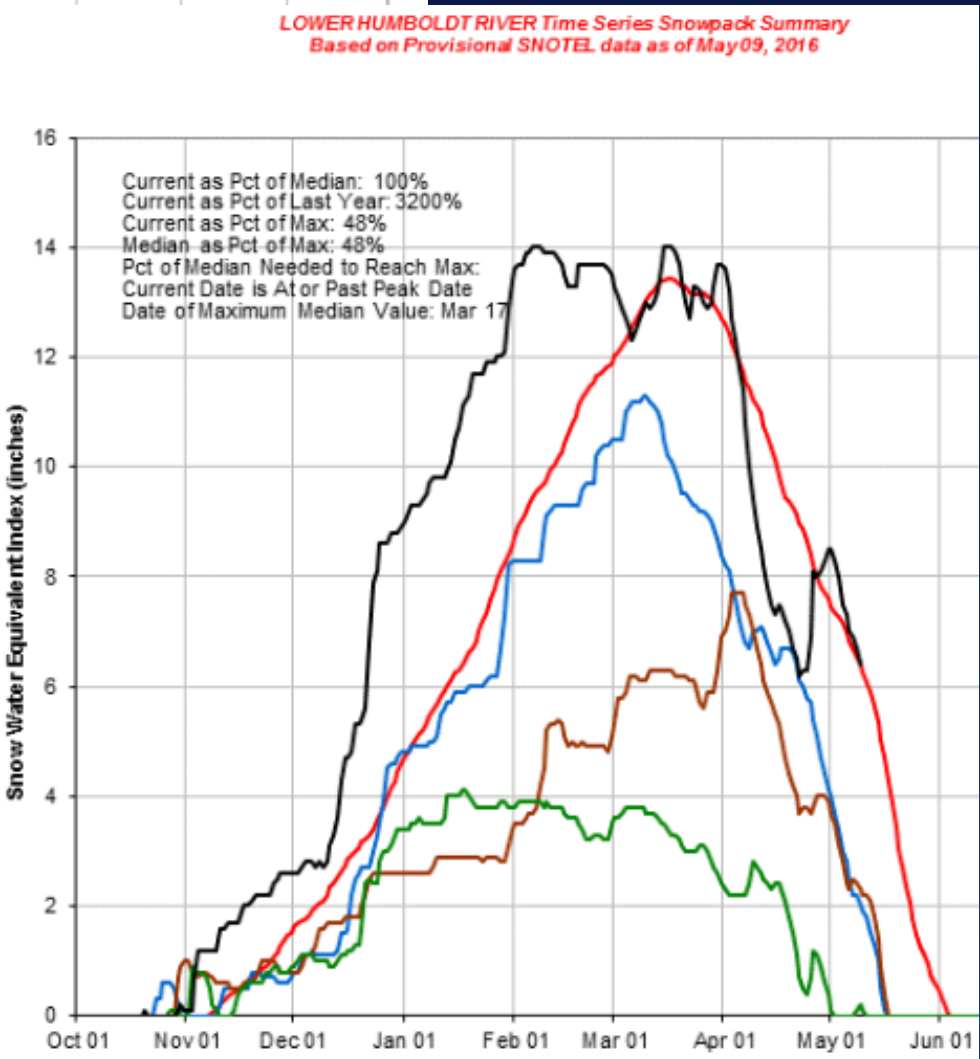
1st of Month Snow Water Equivalent Basin-wide Percent of 1981-2010 Median

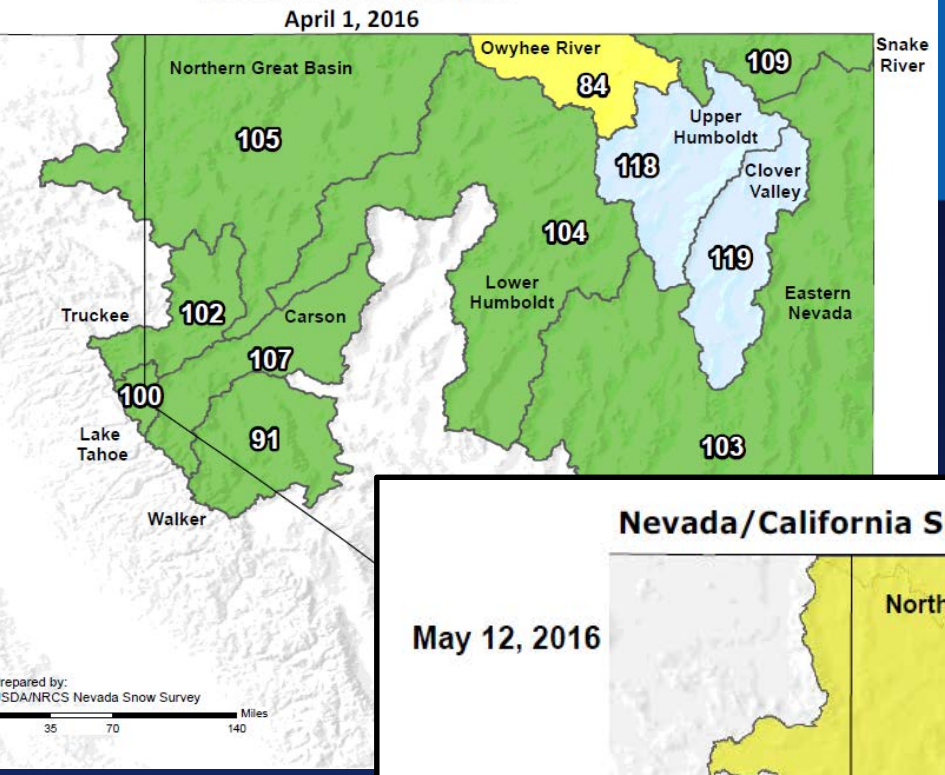
- <50%
- 50-69%
- 70-89%
- 90-109%
- 110-129%
- 130-150%
- >150%

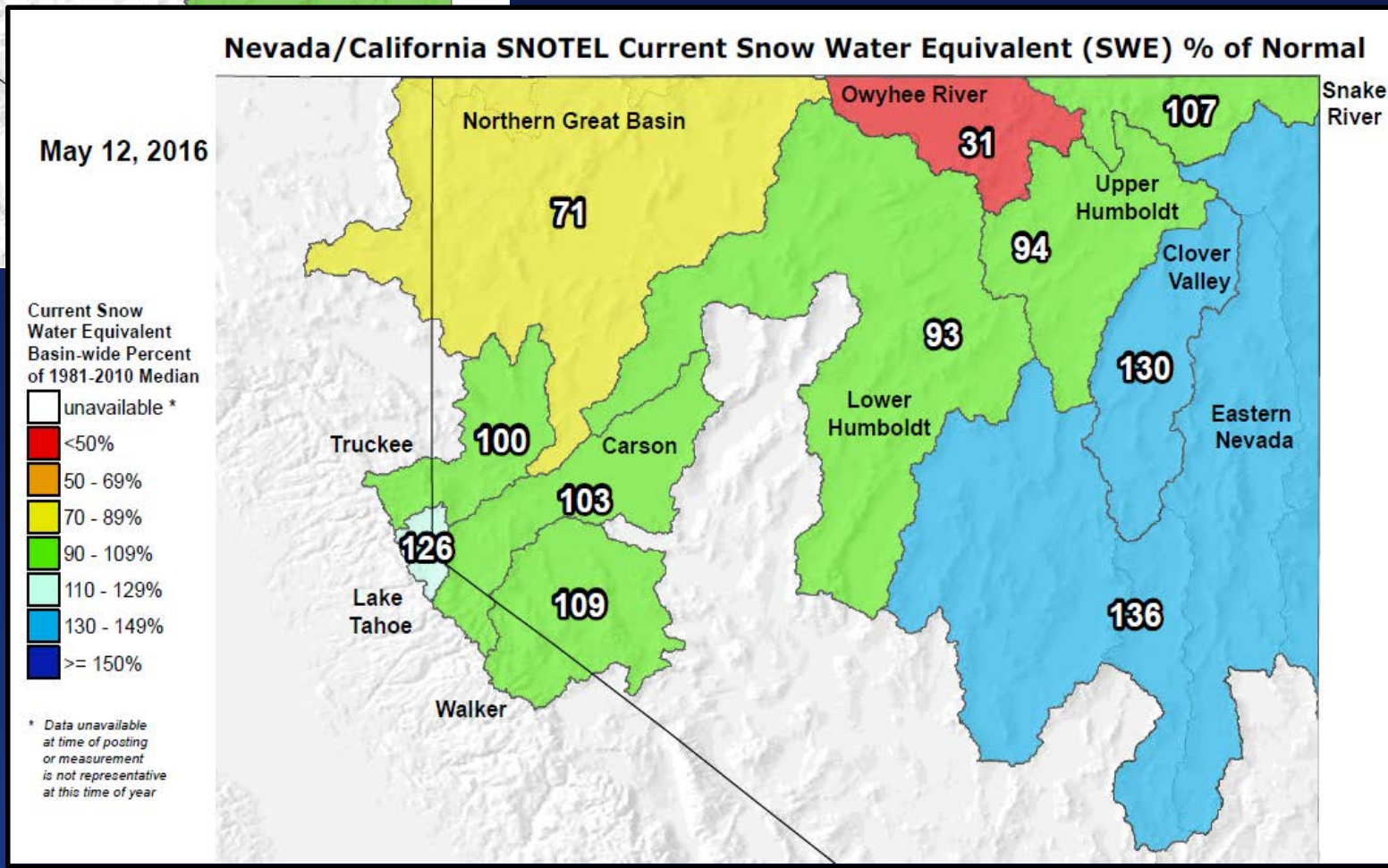
Provisional data subject to revision

Map data based on the first of month snow water equivalent found at selected SNOTEL and snow course sites in or near the basin compared to the median value for those sites. SNOTEL data based on the first reading of the day (typically midnight). Snow course data based on measurements taken within the last 5 days of preceding month. A table based, station-by-station, report of the underlying data can be found by selecting "Nevada" and report type "Snowpack" for the date listed above on the following webpage: http://www.wcc.nrcs.usda.gov/basin.html.


UPPER HUMBOLDT RIVER Time Series Snowpack Summary
Based on Provisional SNOTEL data as of May 09, 2016
Current as Pct of Median: 121%
Current as Pct of Last Year: 1367%
Current as Pct of Max: 31%
Median as Pct of Max: 26%
Pct of Median Needed to Reach Max:
Current Date is At or Past Peak Date
Date of Maximum Median Value: Mar 16
Snow Water Equivalent Index (inches)
0
2
4
6
8
10
12
14
16
18
Oct 01
Nov 01
Dec 01
Jan 01
Feb 01
Mar 01
Apr 01
May 01
Jun
Median
WY2013
WY2014
WY2015
WY2016


LOWER HUMBOLDT RIVER Time Series Snowpack Summary
Based on Provisional SNOTEL data as of May 09, 2016
Current as Pct of Median: 100%
Current as Pct of Last Year: 3200%
Current as Pct of Max: 48%
Median as Pct of Max: 48%
Pct of Median Needed to Reach Max:
Current Date is At or Past Peak Date
Date of Maximum Median Value: Mar 17
Snow Water Equivalent Index (inches)
0
2
4
6
8
10
12
14
16
Oct 01
Nov 01
Dec 01
Jan 01
Feb 01
Mar 01
Apr 01
May 01
Jun 01


April 1, 2016
Northern Great Basin
Owyhee River
Snake River
84
109
105
Upper Humboldt
118
Clover Valley
104
119
Lower Humboldt
Eastern Nevada
Truckee
102
Carson
107
100
Lake Tahoe
91
103
Walker
repared by:
SDA/NRCS Nevada Snow Survey
Miles
35
70
140


Nevada/California SNOTEL Current Snow Water Equivalent (SWE) % of Normal
May 12, 2016
Current Snow Water Equivalent Basin-wide Percent of 1981-2010 Median
unavailable *
<50%
50 - 69%
70 - 89%
90 - 109%
110 - 129%
130 - 149%
>= 150%
* Data unavailable at time of posting or measurement is not representative at this time of year
Northern Great Basin
Owyhee River
Snake River
107
31
71
Upper Humboldt
94
Clover Valley
93
130
Lower Humboldt
Eastern Nevada
Truckee
100
Carson
103
126
Lake Tahoe
109
136
Walker

United States Department of Agriculture
Natural Resources Conservation Service

USDA NRCS

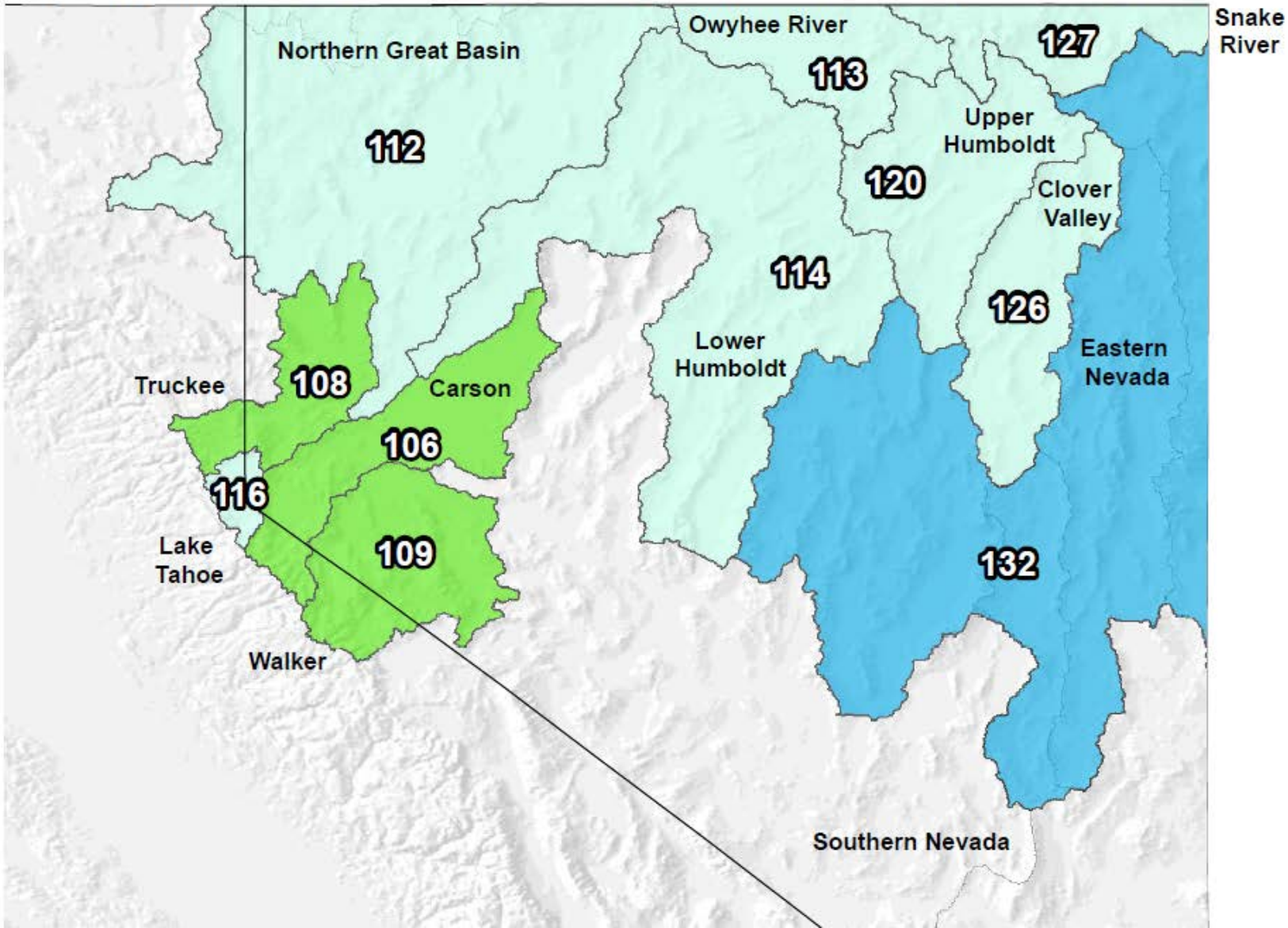
Nevada/California SNOTEL Water Year (Oct 1) to Date Precipitation % of Normal

May 12, 2016

Water Year (Oct 1) to Date Precipitation Basin-wide Percent of 1981-2010 Average

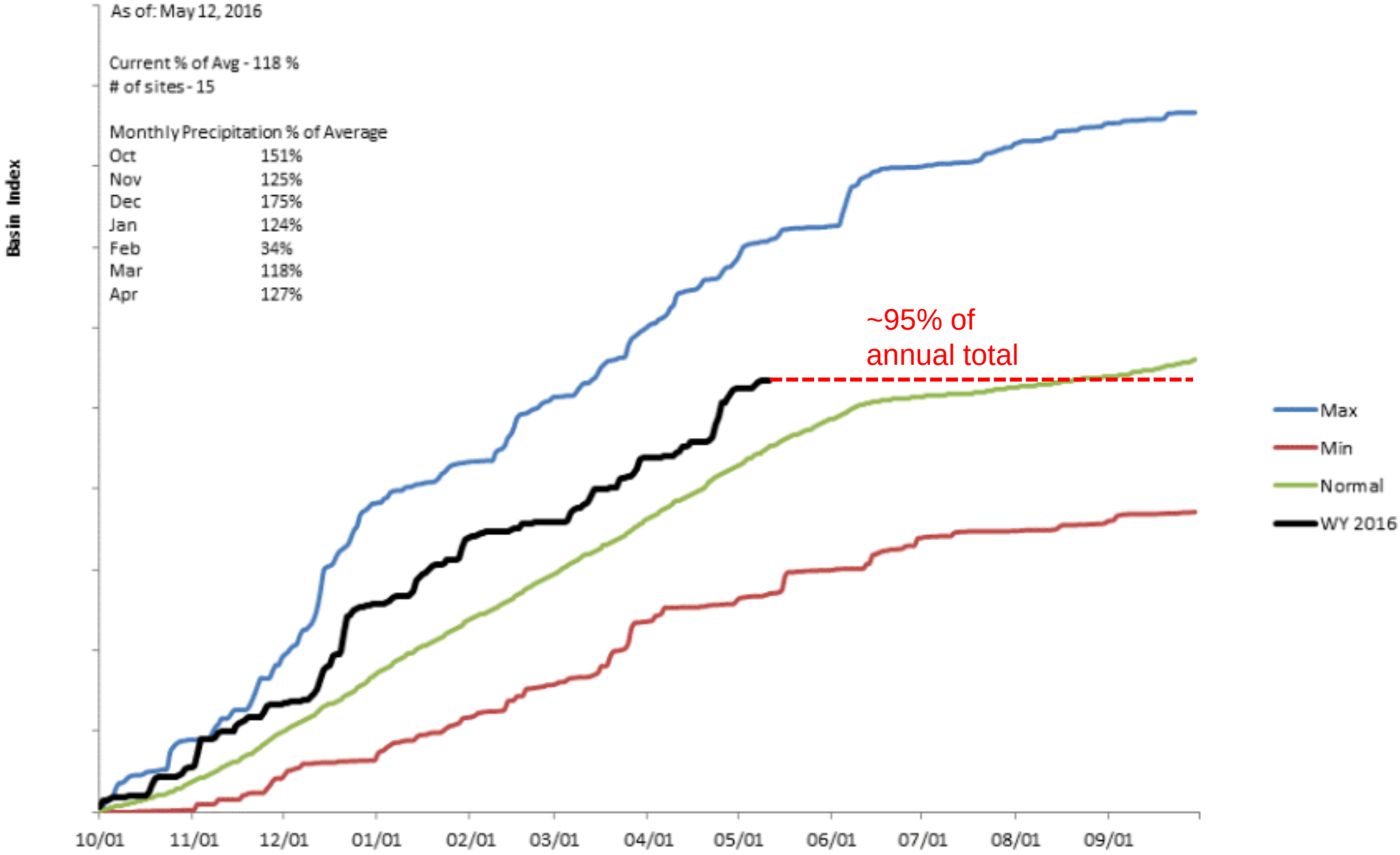
- unavailable *
- <50%
- 50 - 69%
- 70 - 89%
- 90 - 109%
- 110 - 129%
- 130 - 149%
- >= 150%

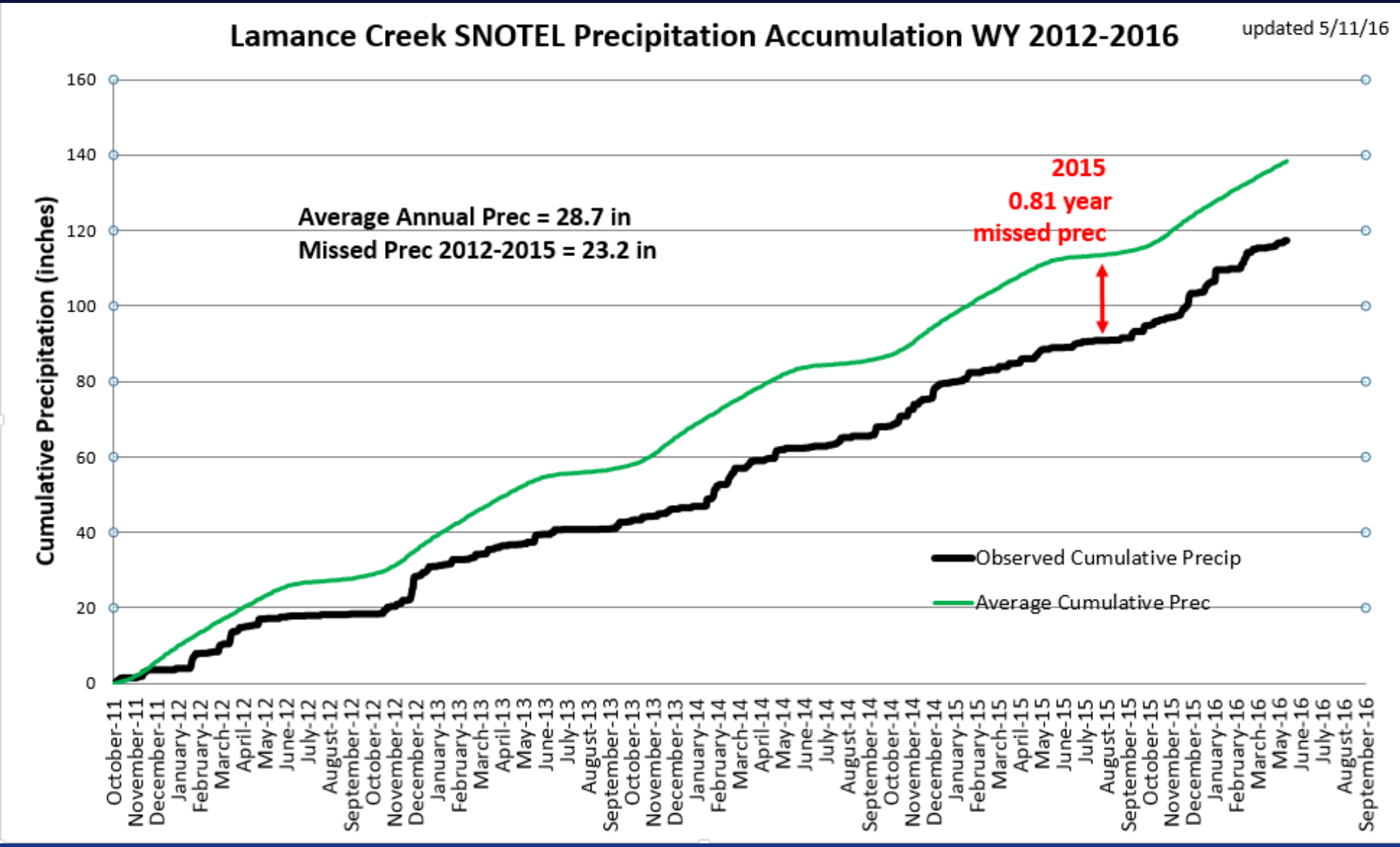
* *Data unavailable at time of posting or measurement is not representative at this time of year*



Provisional data subject to revision

Humboldt River above Imlay
Precipitation




Lamance Creek SNOTEL Precipitation Accumulation WY 2012-2016
updated 5/11/16
Cumulative Precipitation (inches)
0
20
40
60
80
100
120
140
160
Average Annual Prec = 28.7 in
Missed Prec 2012-2015 = 23.2 in
2015
0.81 year
missed prec
Observed Cumulative Precip
Average Cumulative Prec
October-11
November-11
December-11
January-12
February-12
March-12
April-12
May-12
June-12
July-12
August-12
September-12
October-12
November-12
December-12
January-13
February-13
March-13
April-13
May-13
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July-13
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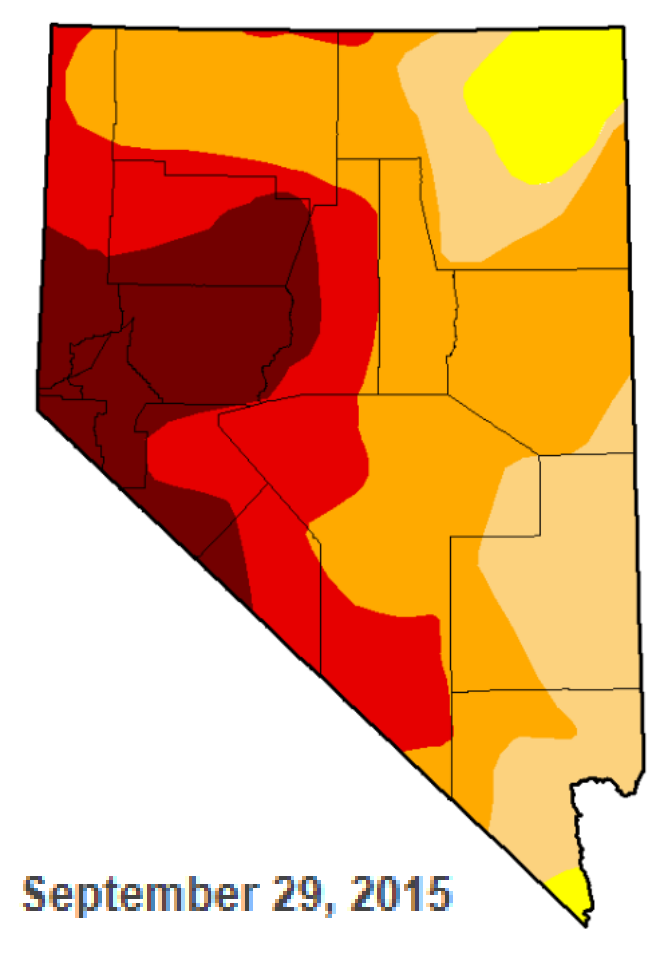
November-14
December-14
January-15
February-15
March-15
April-15
May-15
June-15
July-15
August-15
September-15
October-15
November-15
December-15
January-16
February-16
March-16
May-16
June-16
July-16
August-16
September-16

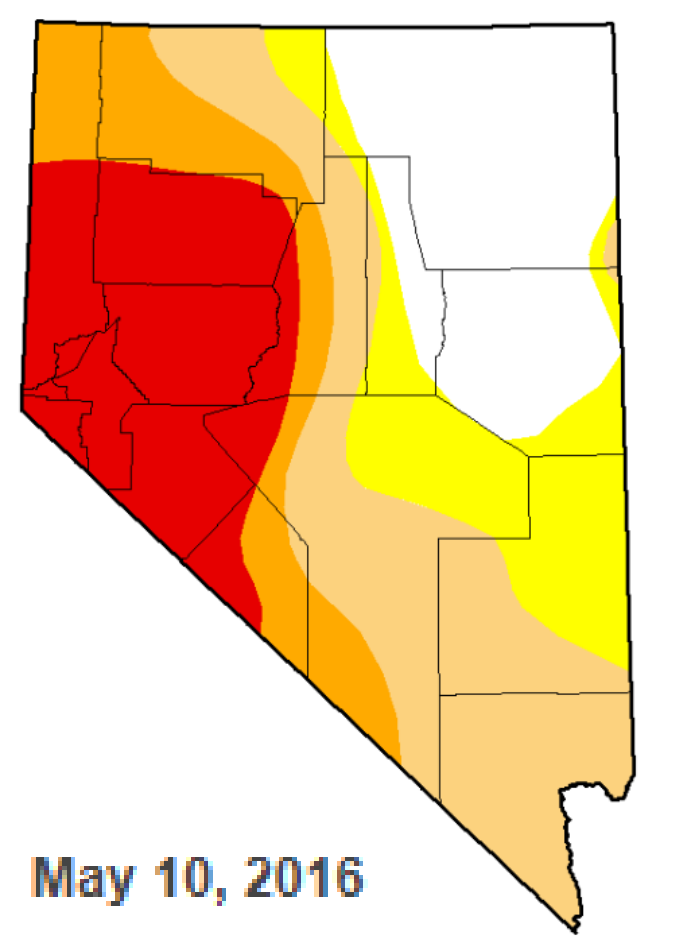
Missed Precipitation Water Years 2012-2015

Basin	# Sites	Average # Years Missed Prec
Truckee	8	1.3
Carson	9	1.3
Walker	6	1.2
Tahoe	7	1.1
Humboldt	10	0.7
Eastern Nevada	3	0.5
Snake - Owyhee, Burneau, Salmon Falls	9	0.4

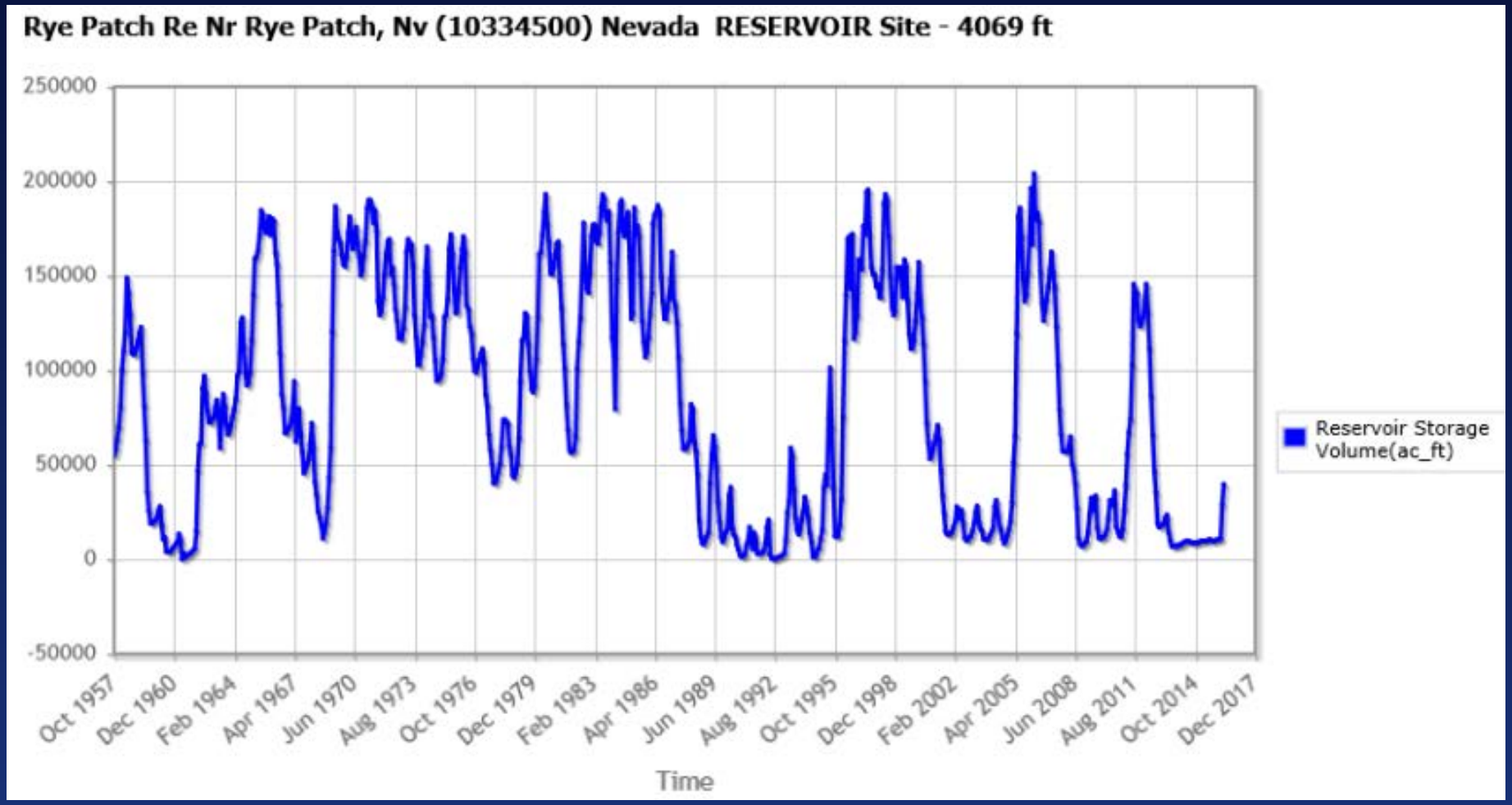
SNOTEL Site	Elevation	2012-2015 Missed Precip (inches)	Average Annual Precip	Years of Prec Missed
Lewis Peak	7400	28.0	25.7	1.1
Big Creek Sum	8695	27.4	26.3	1.0
Granite Peak	8543	30.6	32.3	0.9
Lamoille #3	7700	28.2	32.3	0.9
Lamance Creek	6000	23.2	28.7	0.8
Dorsey Basin	8100	18.5	33.0	0.6
Green Mountain	8000	17.6	32.0	0.6
Buckskin Lower	6915	11.6	24.5	0.5
Draw Creek	7200	7.8	20.2	0.4
Corral Canyon	8500	9.7	30.0	0.3
Average				**0.7**

US Drought Monitor

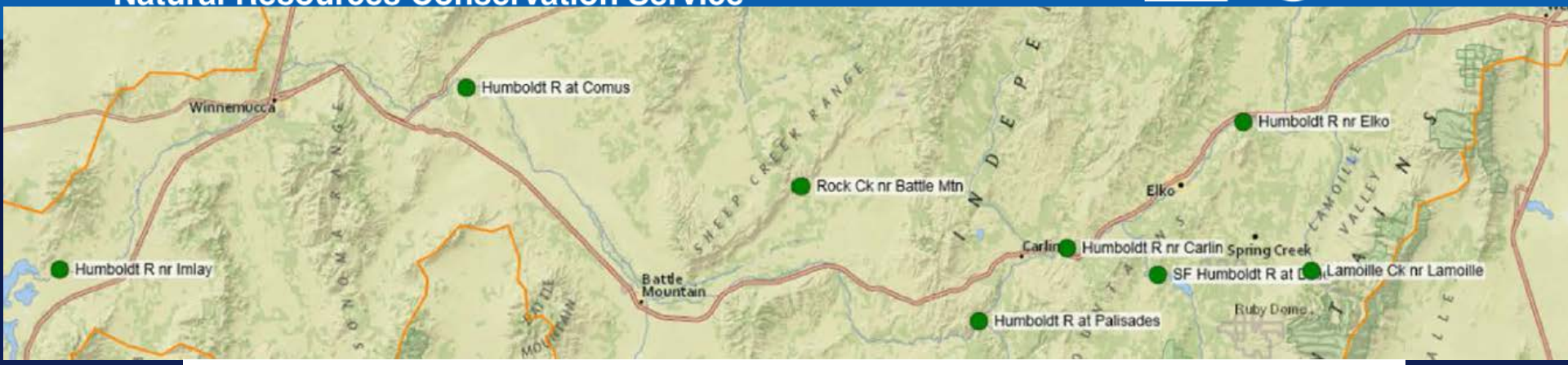


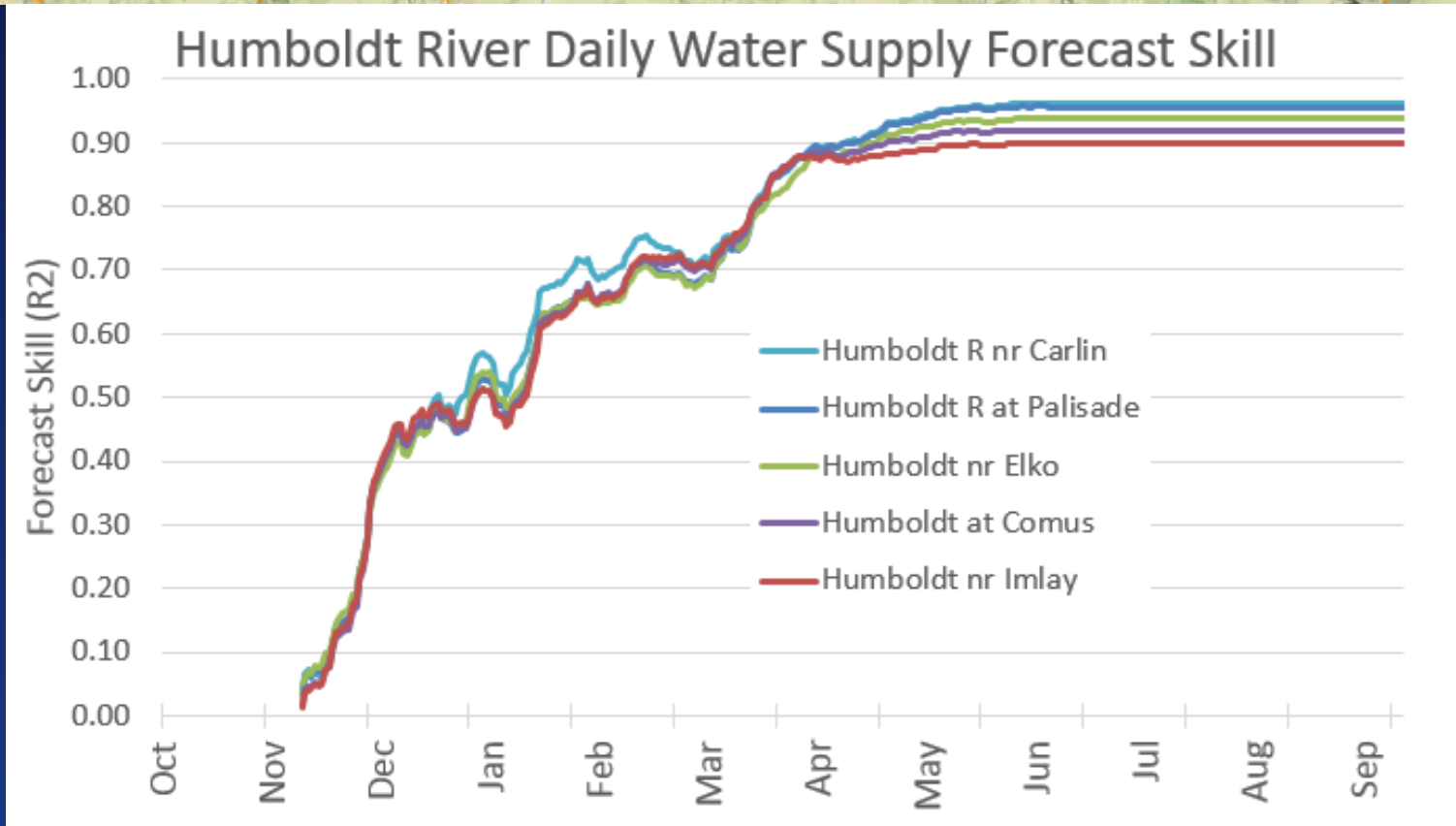


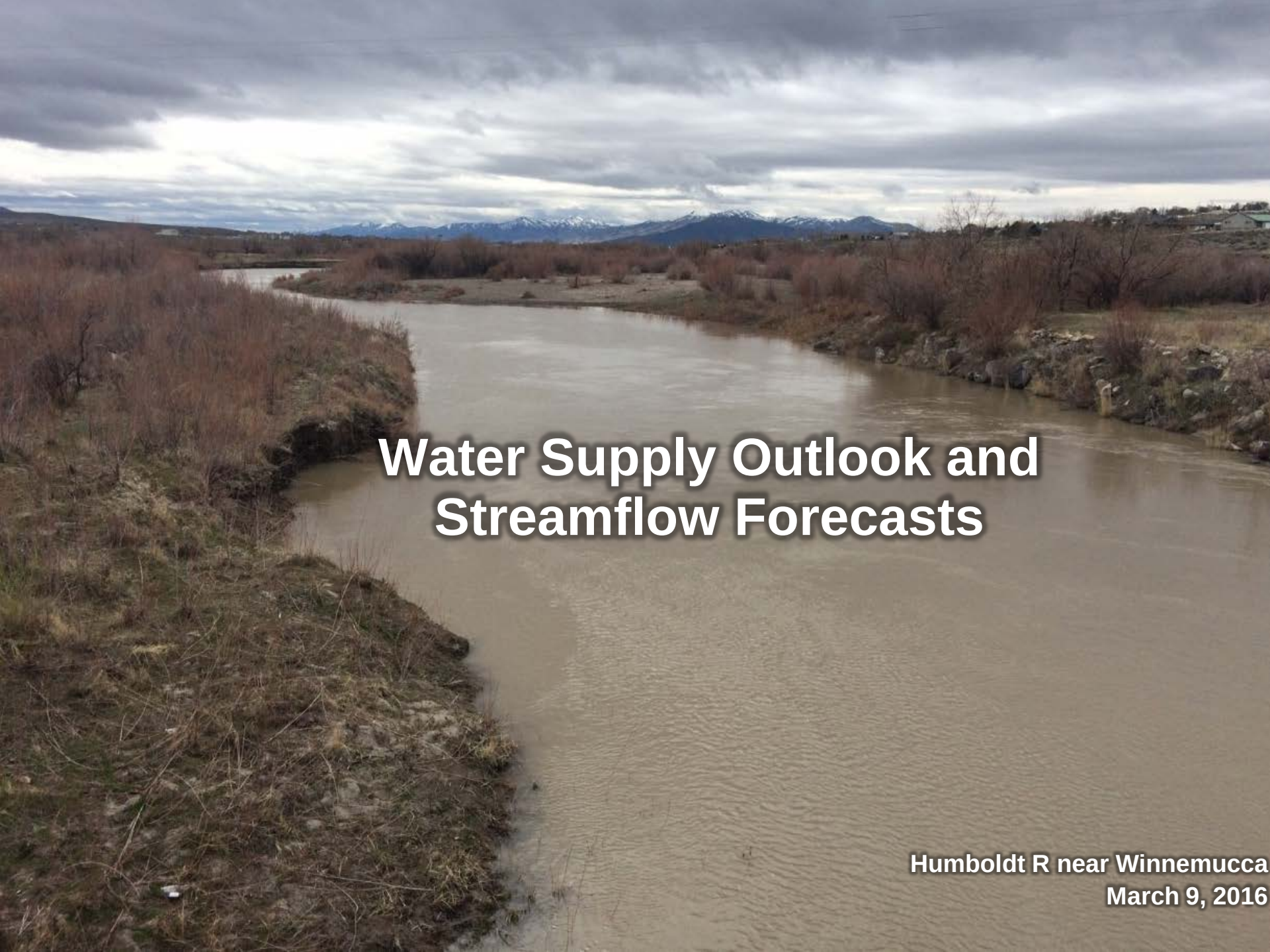
Category	Description
D0	Abnormally Dry
D1	Moderate Drought
D2	Severe Drought
D3	Extreme Drought
D4	Exceptional Drought



April 30 storage = 39.7 KAF
20% of capacity

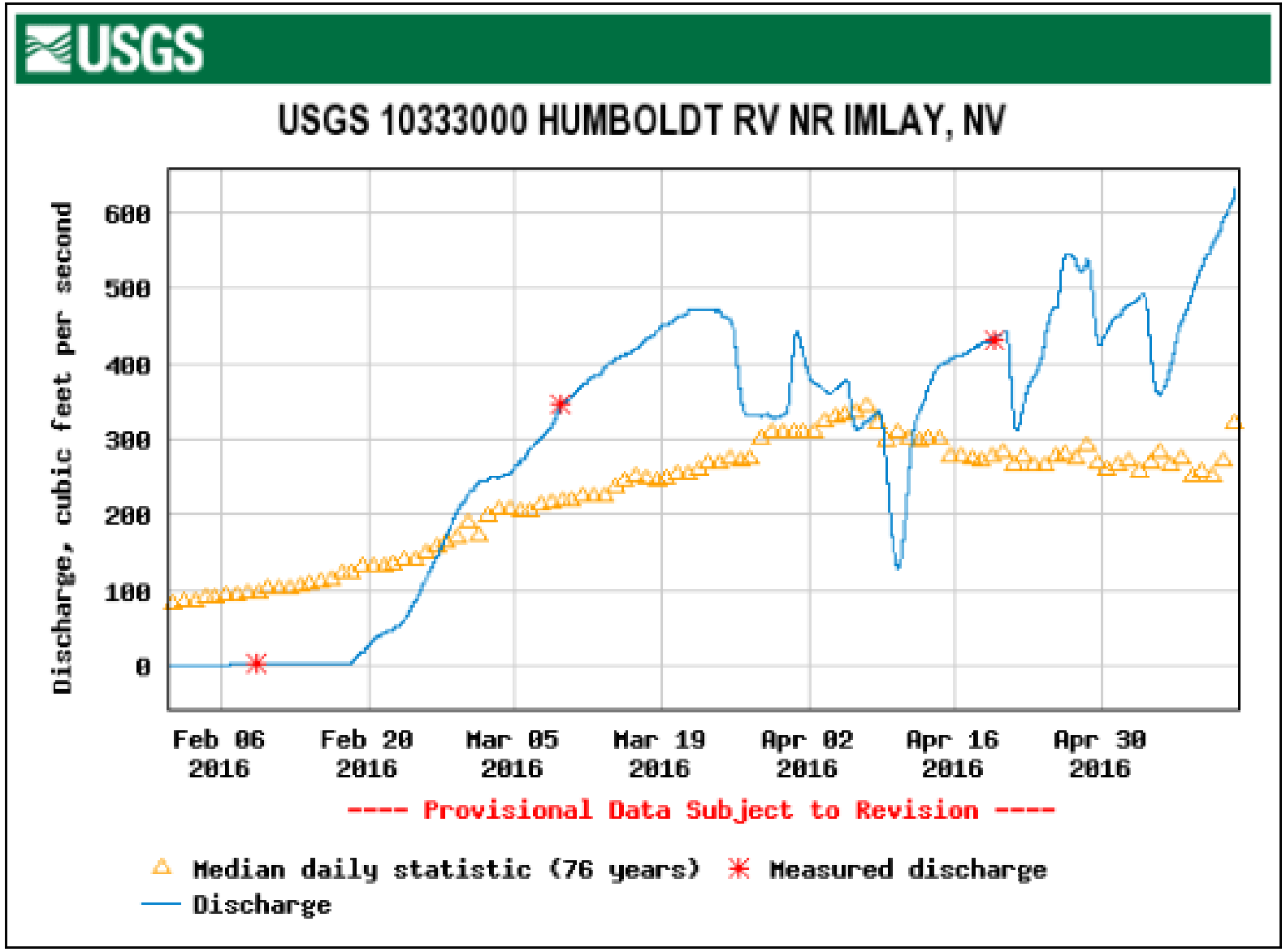

Humboldt R at Comus
Winnemucca
Humboldt R nr Elko
Rock Ck nr Battle Mtn
Elko
Humboldt R nr Imlay
Carlin
Humboldt R nr Carlin
Spring Creek
SF Humboldt R at
Lamoille Ck nr Lamoille
Battle Mountain
Humboldt R at Palisades
Ruby Dome


Humboldt River Daily Water Supply Forecast Skill
Forecast Skill (R2)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Humboldt R nr Carlin
Humboldt R at Palisade
Humboldt nr Elko
Humboldt at Comus
Humboldt nr Imlay

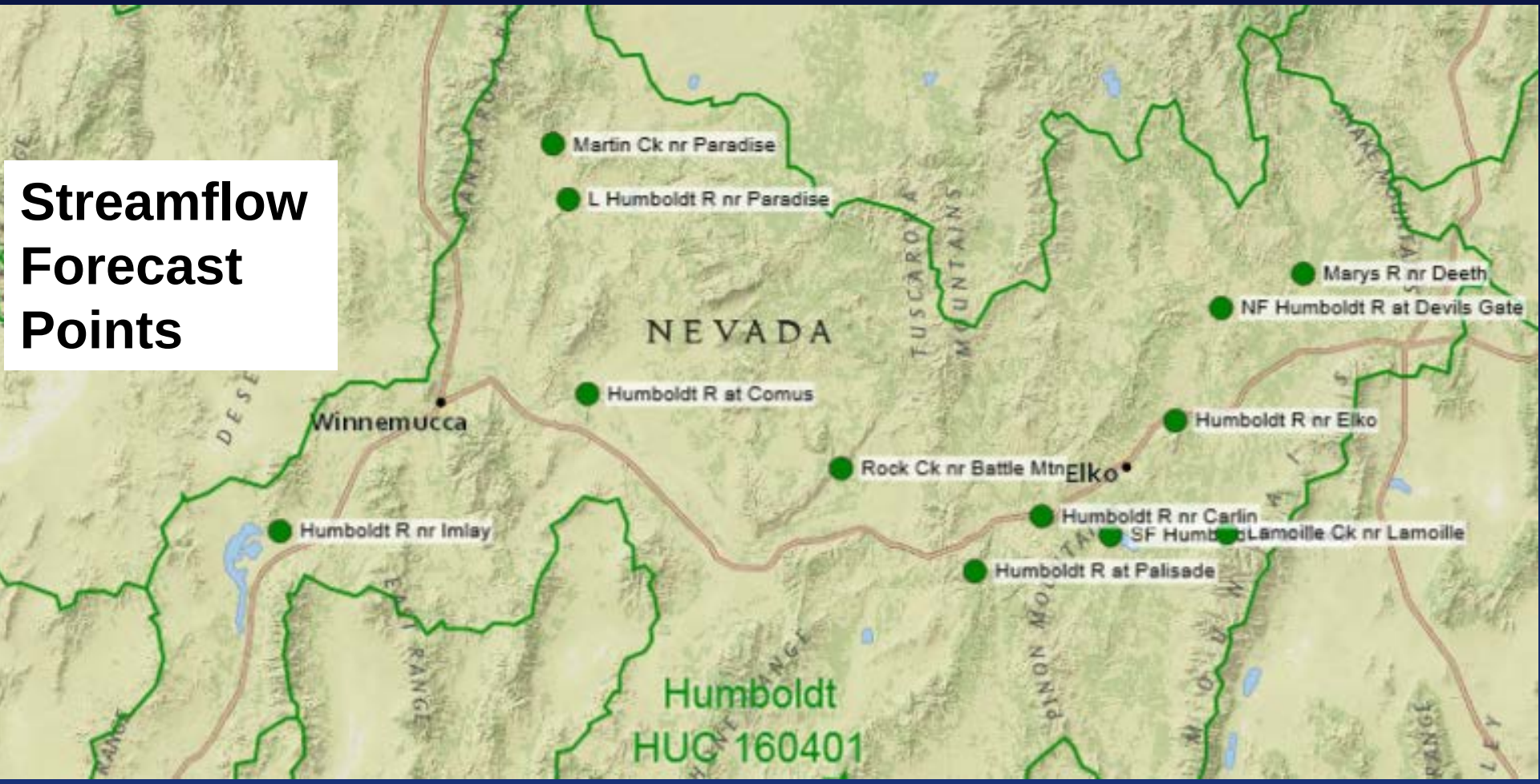


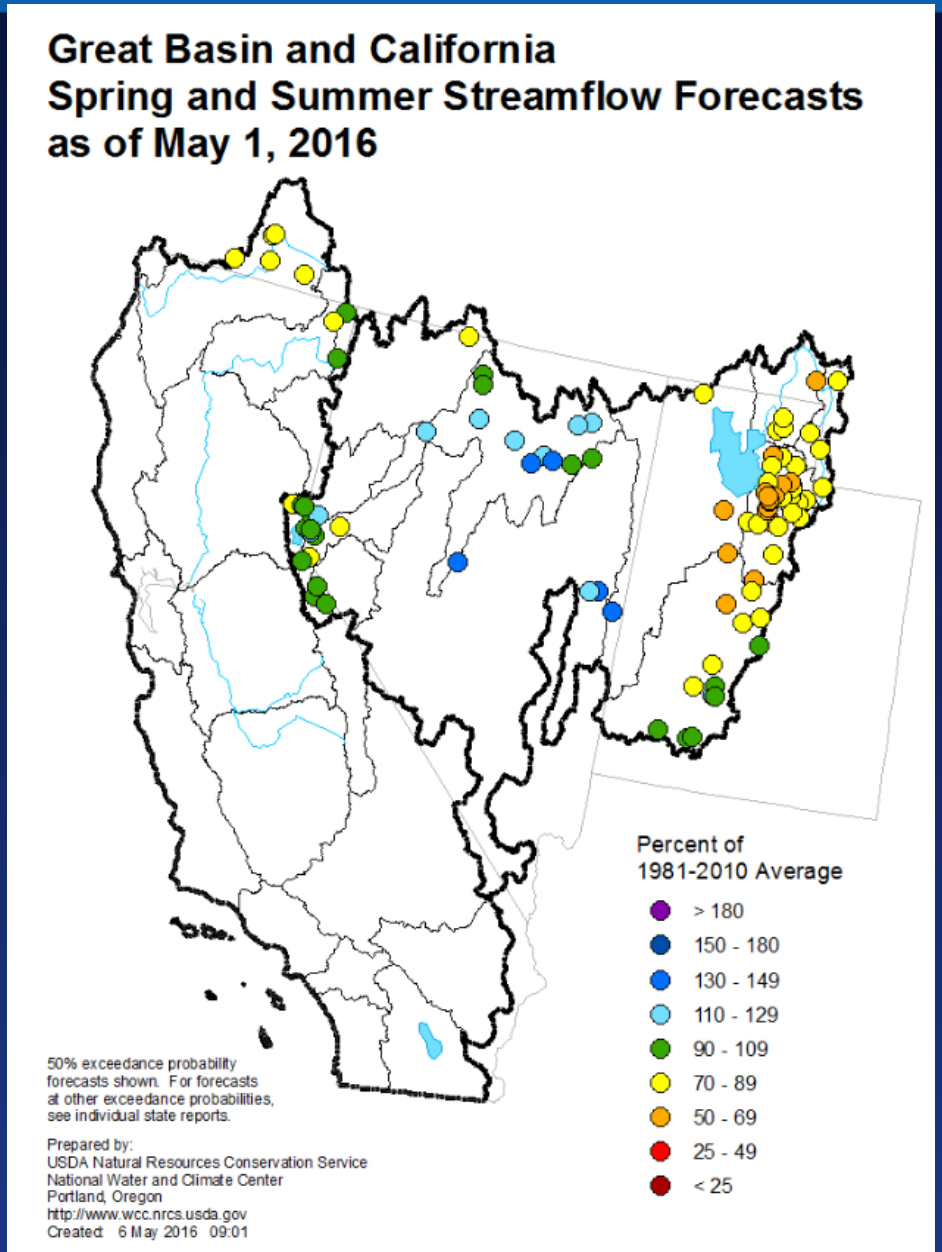
Water Supply Outlook and Streamflow Forecasts

Humboldt R near Winnemucca
March 9, 2016


USGS
USGS 10333000 HUMBOLDT RV NR IMLAY, NV
Discharge, cubic feet per second
600
500
400
300
200
100
0
Feb 06 2016
Feb 20 2016
Mar 05 2016
Mar 19 2016
Apr 02 2016
Apr 16 2016
Apr 30 2016
---- Provisional Data Subject to Revision ----
Median daily statistic (76 years)
Measured discharge
Discharge

Streamflow Forecast Points





Humboldt Basin May 1 forecasts range from:

91% for Martin Ck nr Paradise
to
136% for SF Humboldt R

Humboldt River forecasts average 126% above Palisade and 106% below

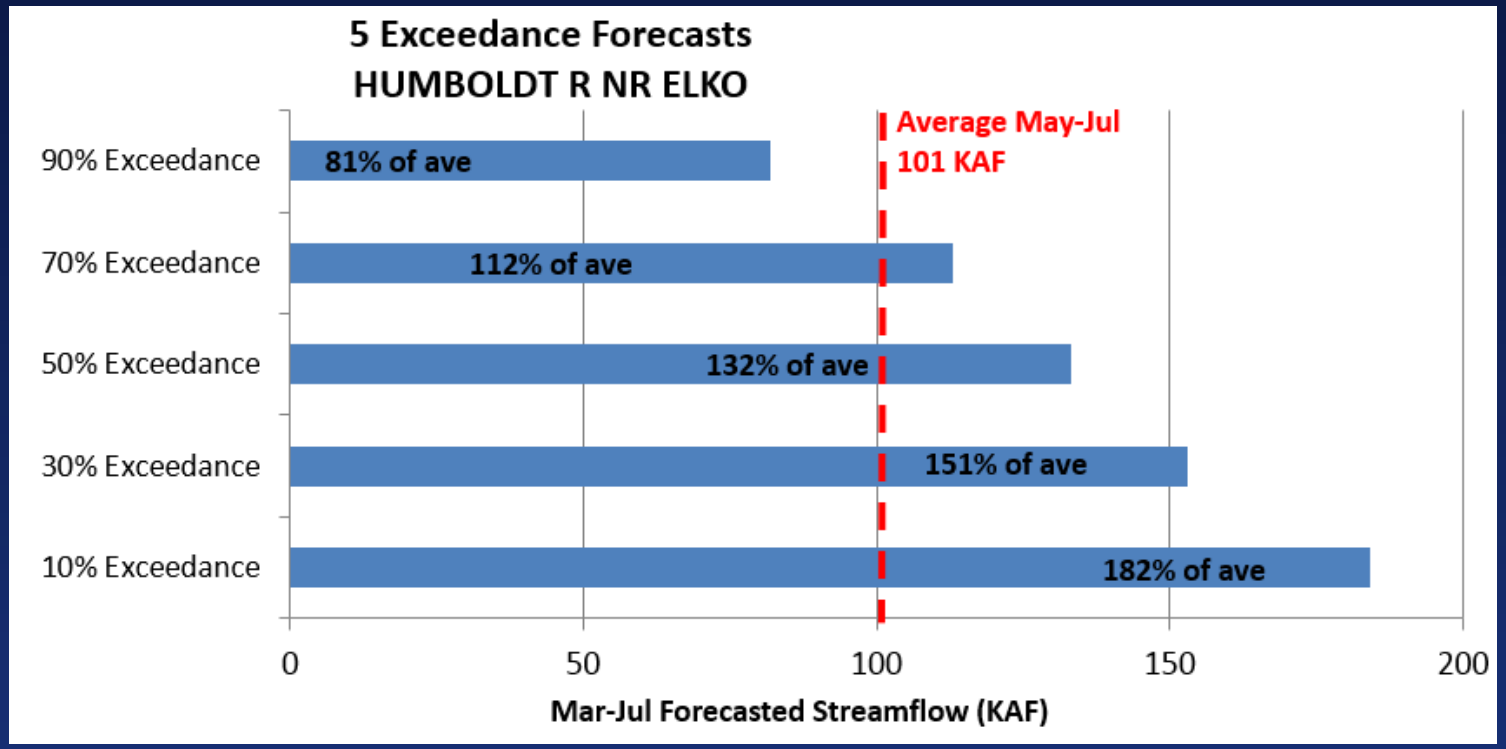
Drier than Normal Future

↑

Normal Future Precip

↓

Wetter than Normal Future



Forecast Exceedance Probabilities for Risk Assessment
Chance that actual volume will exceed forecast

Upper Humboldt River Basin	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Marys R nr Deeth								
	APR-JUL	21	34	43	119%	52	65	36
	MAY-JUL	16.5	25	31	119%	37	46	26
Lamoille Ck nr Lamoille								
	APR-JUL	21	28	33	114%	38	45	29
	MAY-JUL	16.7	24	29	107%	34	41	27
NF Humboldt R at Devils Gate								
	APR-JUL	16.4	26	35	109%	48	75	32
	MAY-JUL	10	16.4	23	119%	32	53	19.3
Humboldt R nr Elko								
	APR-JUL	107	141	165	124%	189	223	133
	MAY-JUL	82	113	133	132%	153	184	101
SF Humboldt R at Dixie								
	APR-JUL	66	80	90	136%	100	114	66
	MAY-JUL	51	66	76	133%	86	101	57
Humboldt R nr Carlin								
	APR-JUL	210	240	260	126%	280	310	206
	MAY-JUL	155	185	205	127%	225	255	161
Humboldt R at Palisade								
	APR-JUL	197	250	285	127%	320	375	225
	MAY-JUL	144	193	225	132%	260	310	171

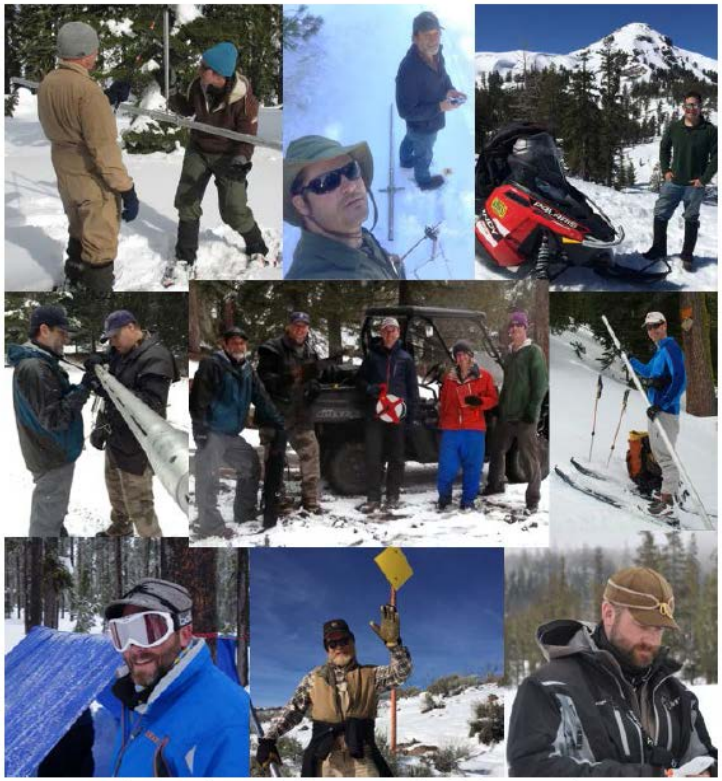
Lower Humboldt River Basin	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Rock Ck nr Battle Mtn								
	APR-JUL	12.3	15.4	17.5	96%	19.6	23	18.2
	MAY-JUL	7.5	10.6	12.7	130%	14.8	18.2	9.8
Humboldt R at Comus								
	APR-JUL	142	194	230	108%	265	320	213
	MAY-JUL	116	159	188	121%	215	260	156
L Humboldt R nr Paradise								
	APR-JUL	6.7	8.7	10	103%	11.3	13.2	9.7
	MAY-JUL	4.3	6.3	7.6	100%	8.9	10.8	7.6
Martin Ck nr Paradise								
	APR-JUL	7.9	12.7	16	91%	19.3	24	17.5
	MAY-JUL	3.6	8.4	11.7	96%	15	19.7	12.2
Humboldt R nr Imlay								
	APR-JUL	60	134	185	104%	235	310	178
	MAY-JUL	46	115	162	122%	210	280	133

United States Department of Agriculture
Natural Resources Conservation Service

USDA United States Department of Agriculture

Natural Resources Conservation Service

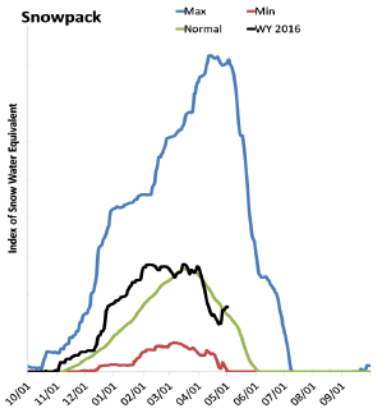
Nevada Water Supply Outlook Report
May 1, 2016

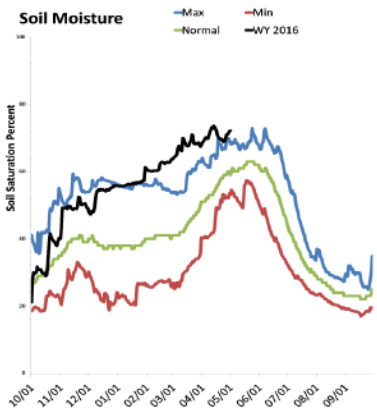


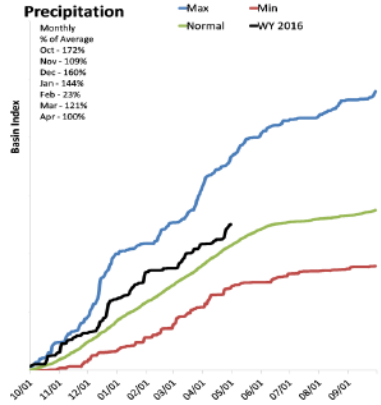
It's tough work, but somebody has to do it

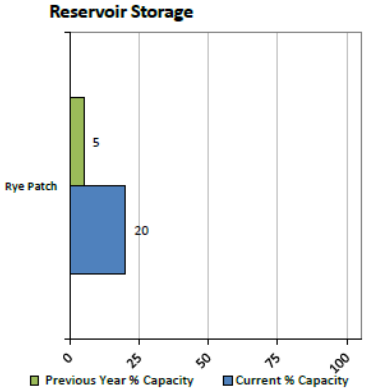
Lower Humboldt River Basin
5/1/2016

Snowpack in the Lower Humboldt River Basin below Palisade is above normal at 113% of median, compared to 1% last year. Precipitation in April was near average at 100%, which brings the seasonal accumulation (Oct-Apr) to 117% of average. Soil moisture is 70% compared to 69% last year. Storage in Rye Patch Reservoir is 20% of capacity, compared to 5% last year. Forecast streamflow volumes range from 91% to 108% of average.





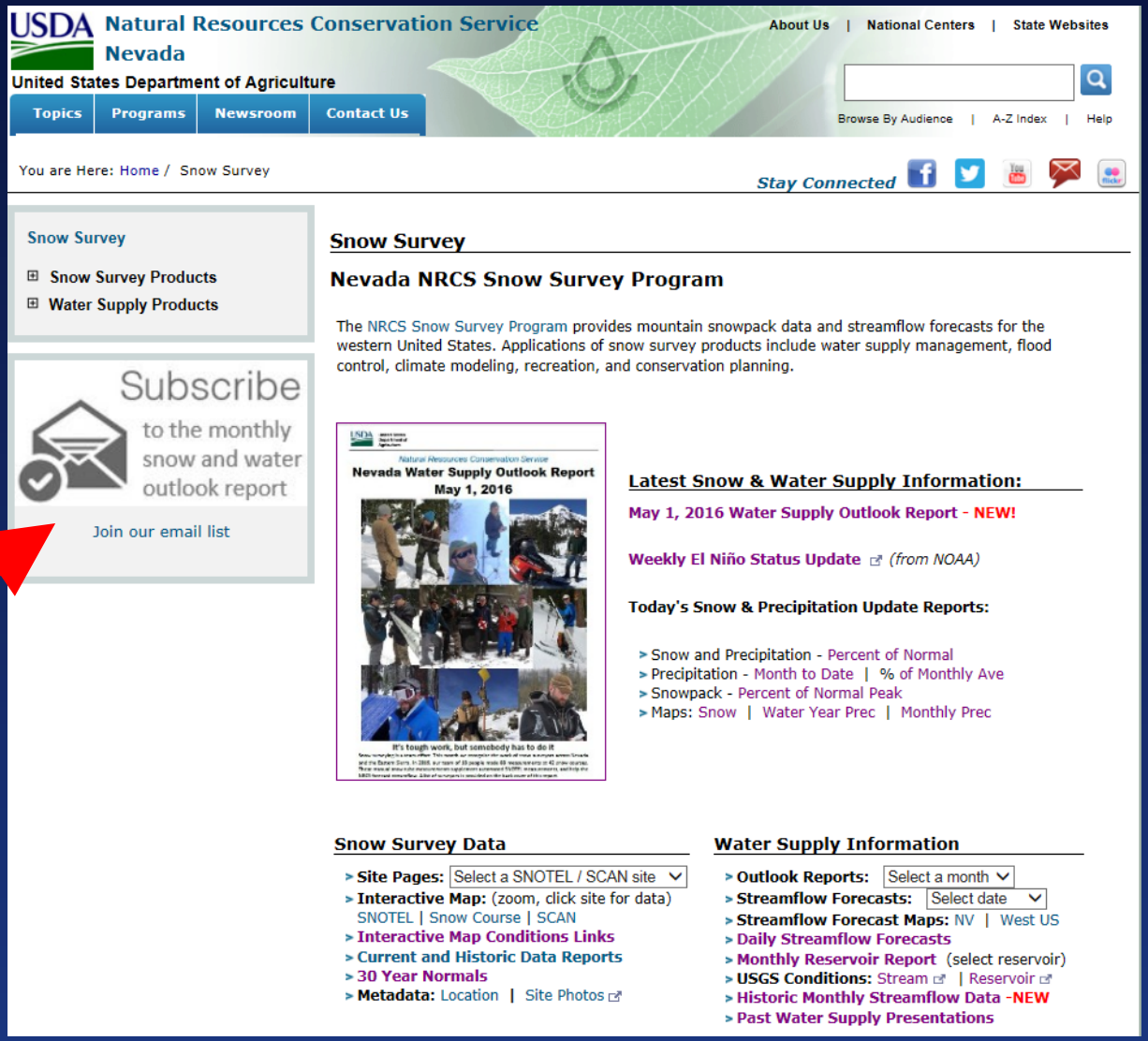




www.nv.nrcs.usda.gov/snow/

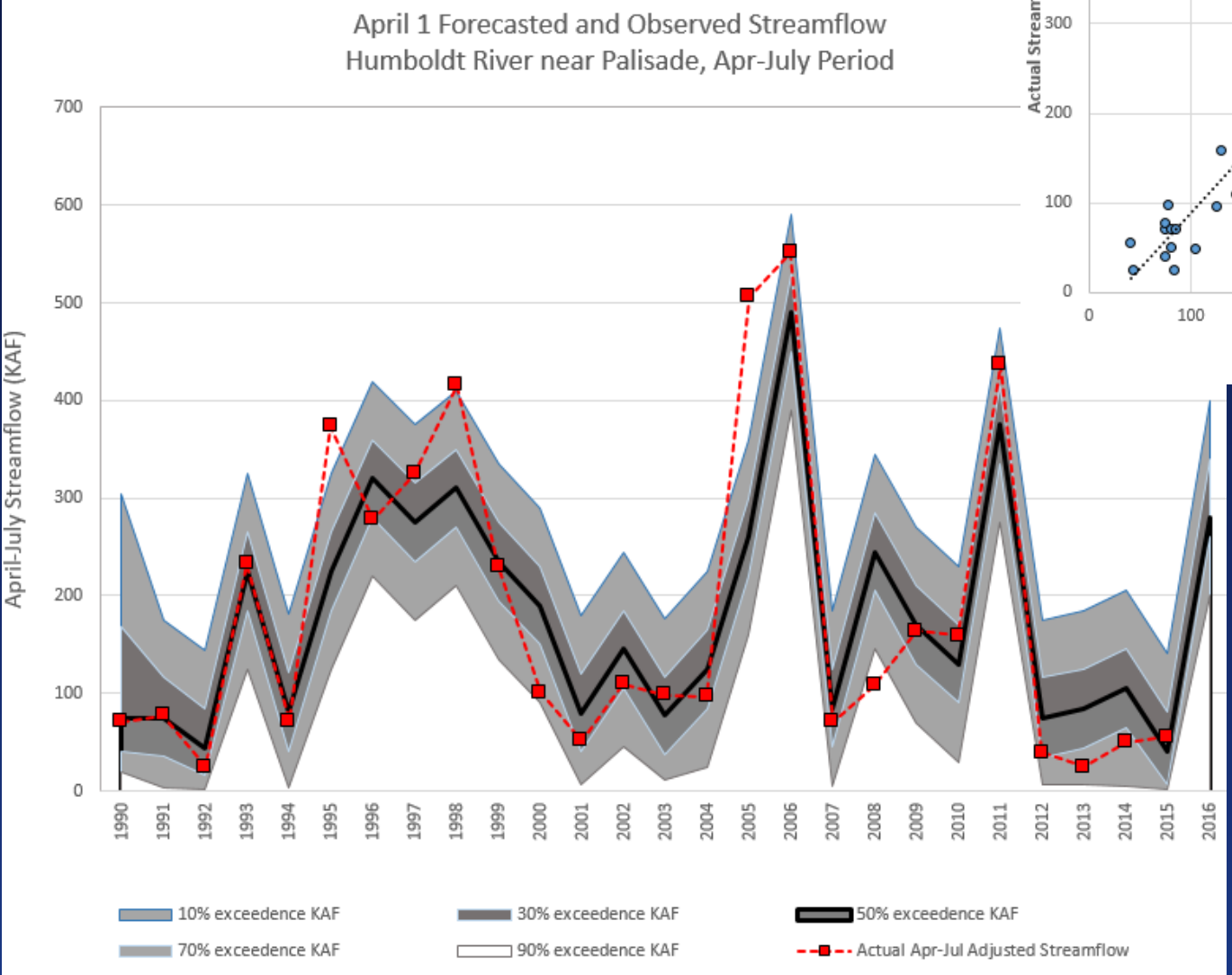
Or just Google…

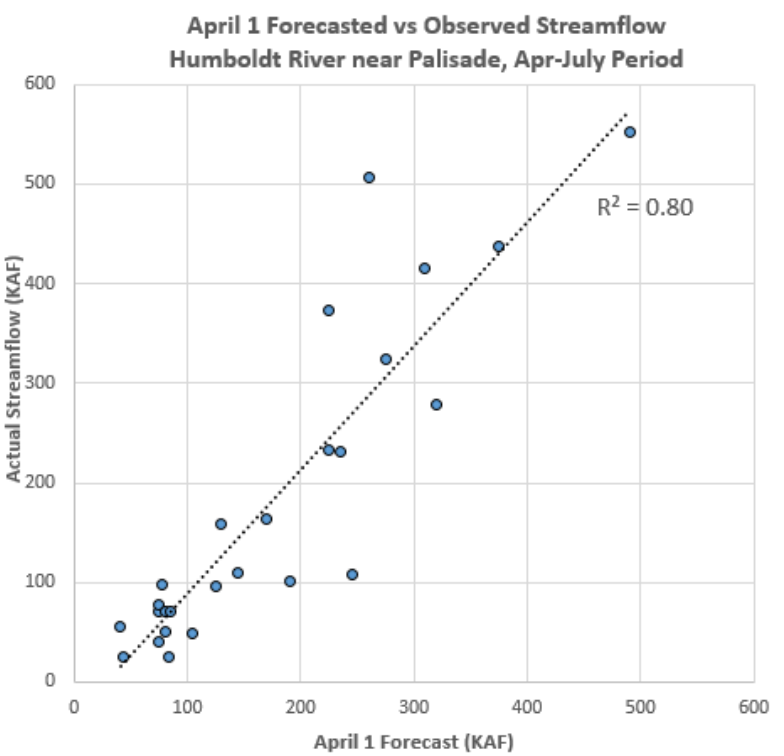
“Nevada NRCS Snow Survey”



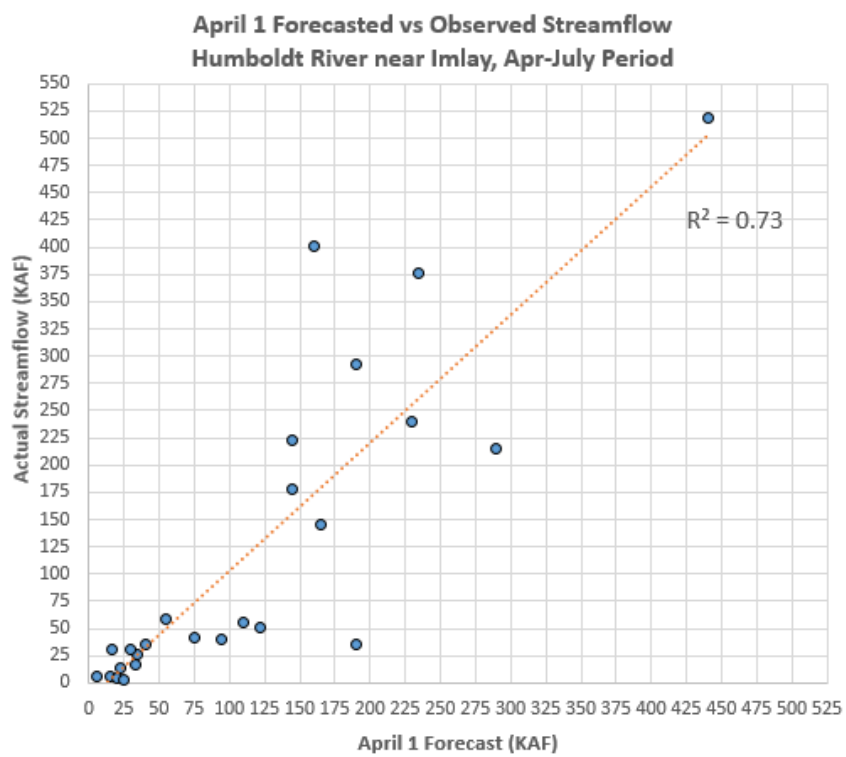
United States Department of Agriculture
Natural Resources Conservation Service

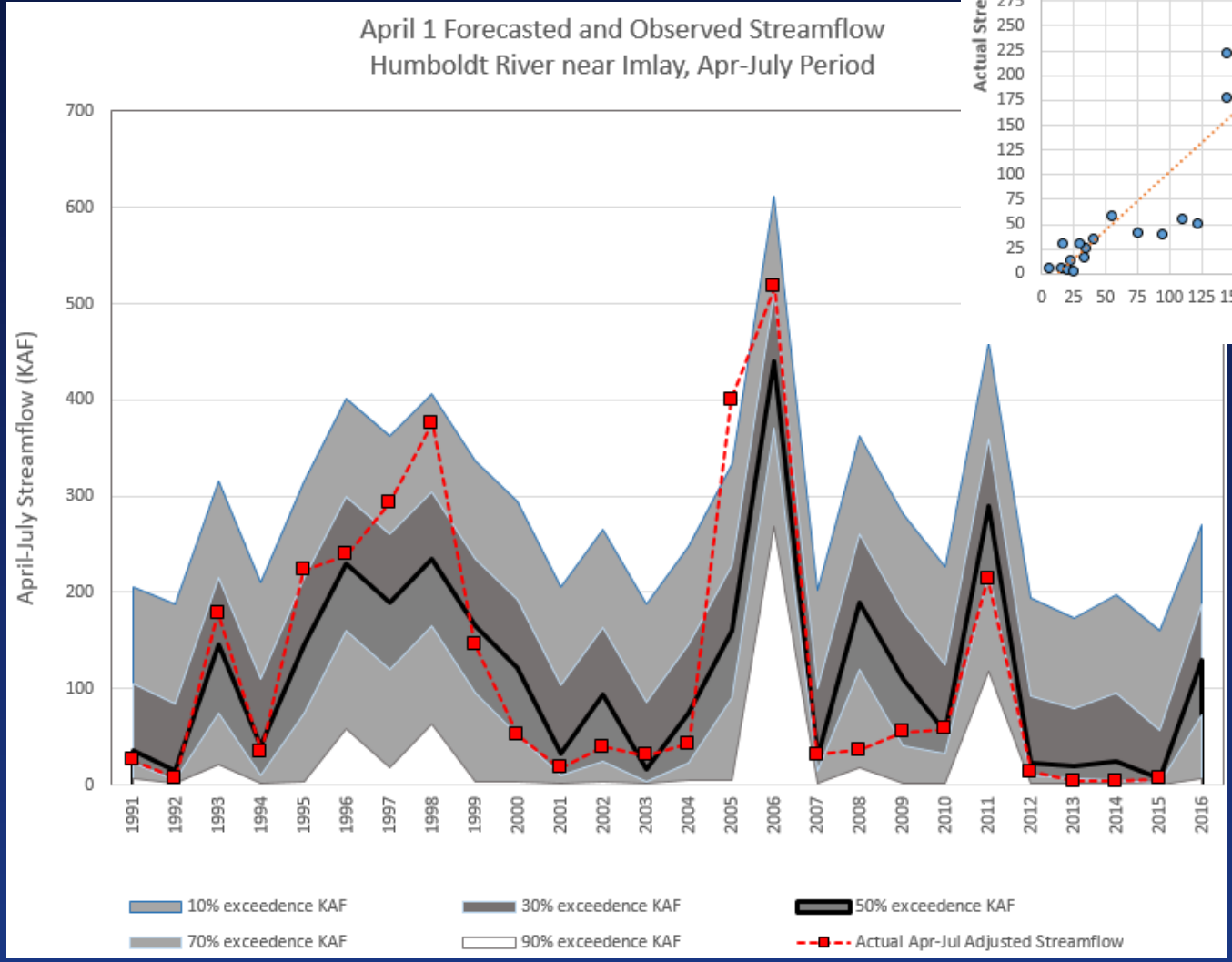
Forecast Skill





United States Department of Agriculture
Natural Resources Conservation Service





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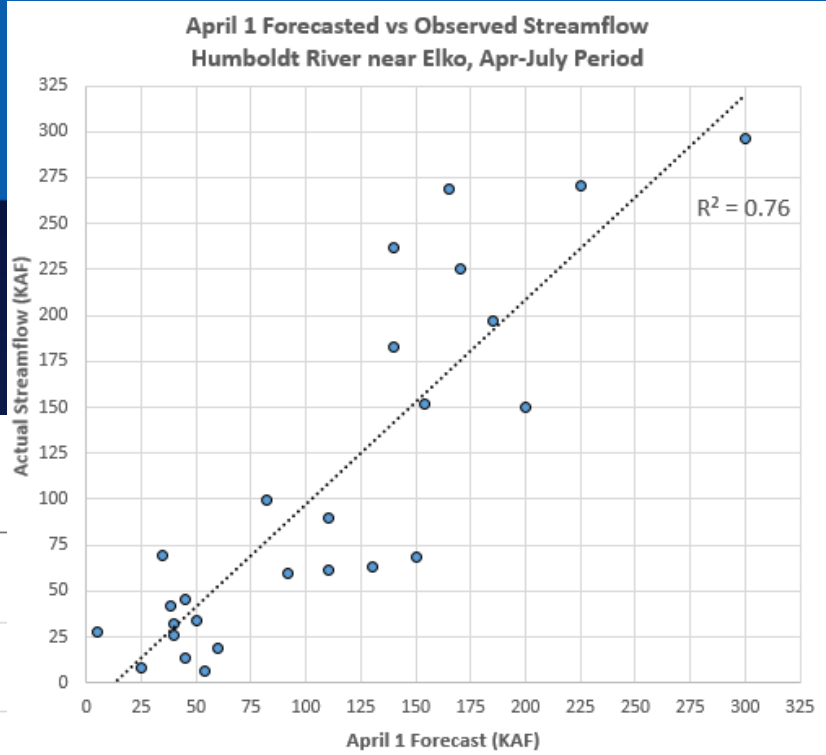
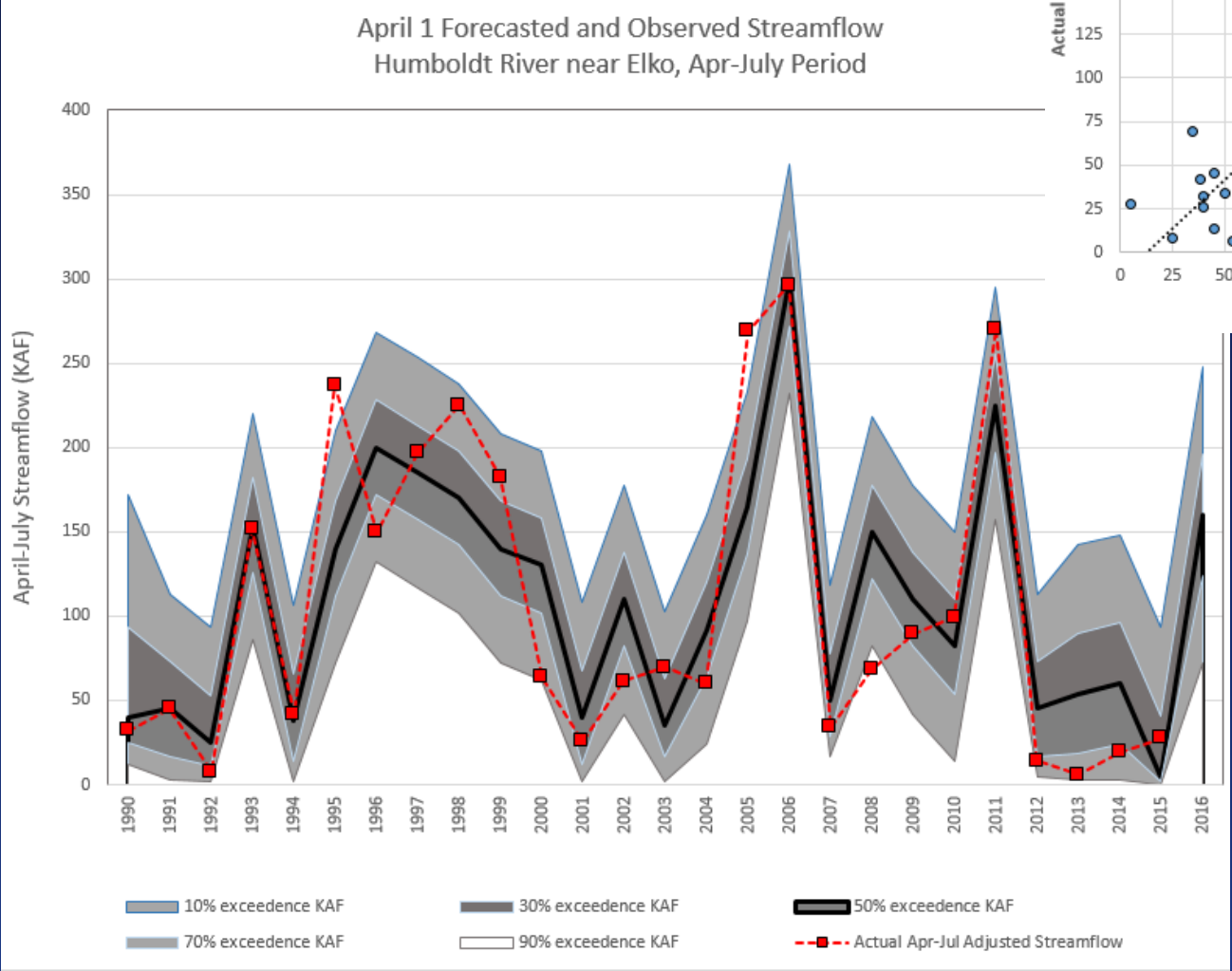
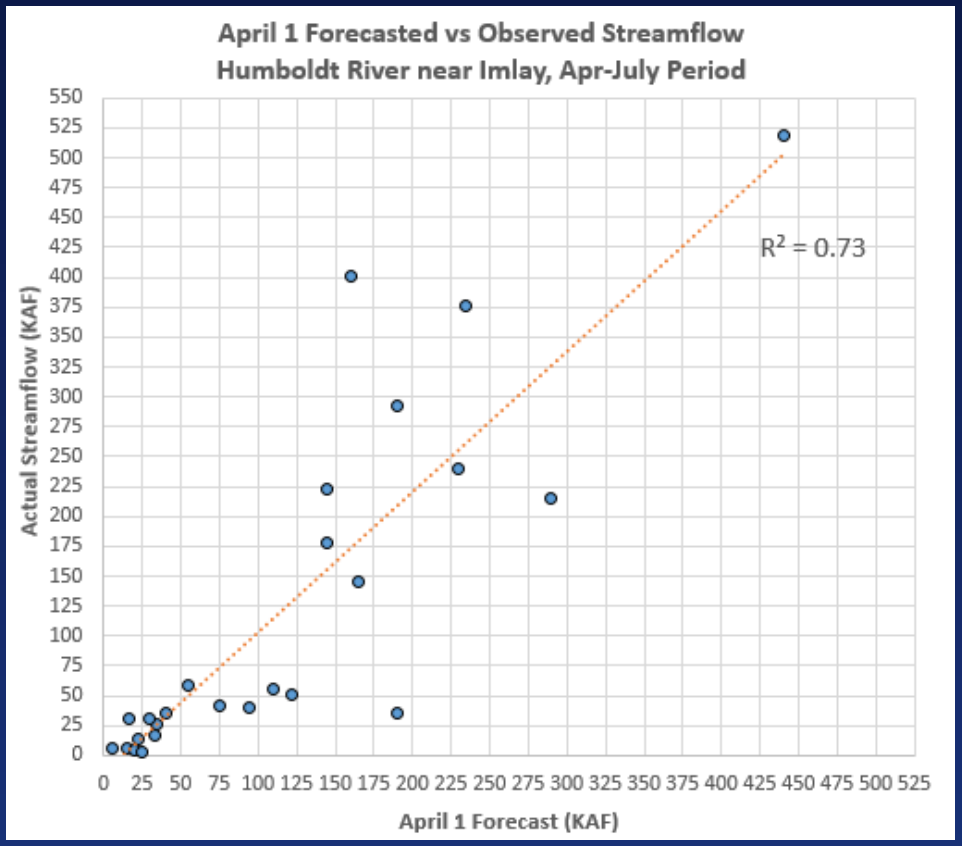
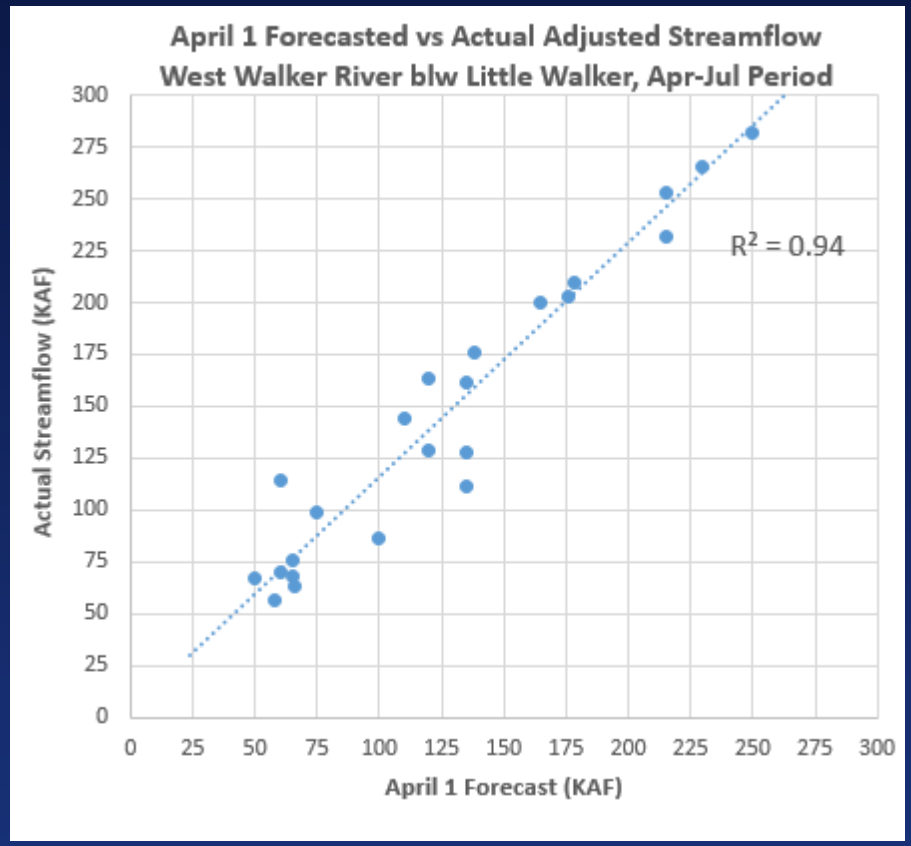
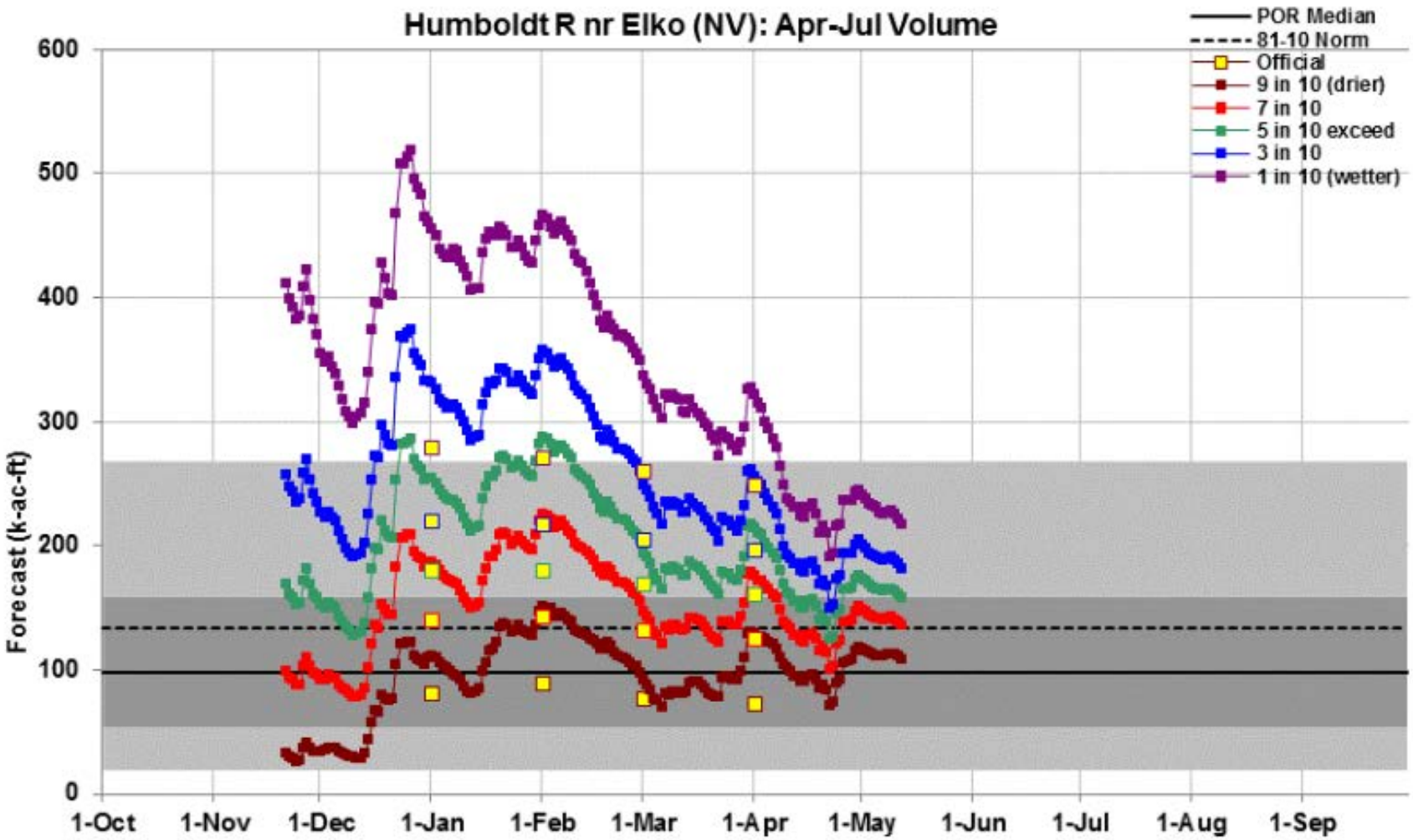




Not all forecasts are equal…







Created 7:29 May 12 2016

This is an automated product based solely on SNOTEL data, provisional data are subject to change. This product is a statistically based guidance forecast combining indices of snowpack and precipitation. **Yellow squares** are the official outlooks. **Gray background** is the historical period of record variability. This product does not consider climate information such as El Nino or short range weather forecasts, or a variety of other factors considered in the official forecasts. This product is not meant to replace or supercede the official forecasts produced in coordination with the National Weather Service. Science Contact: Cara.s.McCarthy@por.usda.gov www.wcc.nrcs.usda.gov/wsf/daily_forecasts.html

As of 2016 the NRCS and NWS-CNRFC are no longer coordinating Humboldt River forecasts

Humboldt River April-July Volume Forecast
Based on March 1, 2016 Data

Streamflow Point	NRCS KAF (%)	NWS KAF (%)	Average KAF
Elko	168 (126%)	140 (105%)	133
Palisade	240 (106%)	249 (110%)	227
Comus	210 (99%)	235 (110%)	213
Imlay	165 (93%)	188 (106%)	178

Summary

- 2016 snowpack peaked above normal (~115%) in the Humboldt basin
- 2016 precipitation is above normal for this date, and ~95% of the average annual total.
- From 2012-2015 the Humboldt basin missed 0.7 years of precipitation. 2016 hasn't replaced this deficit, but at least the hole isn't deeper.
- Drought status has improved. However due to low reservoir storage, the downstream drought status remains extreme.
- Streamflow forecasts (50% exceedence) are 91-136% of average. Humboldt R forecasts average 126% above Palisade & 106% below.
- Humboldt basin presents greater challenges than other basins due to its length, hydrology and/or lack of adequate data. The Palisades forecast has slightly better skill than Imlay or Elko.
- Forecast skill is lower earlier in the season. As more time passes the forecast bounds get tighter (10% and 90% forecasts converge) and overall skill of forecast improves.