



# Application of SWSI to the BWRGWMA

Presented to the BWRGWMA Technical Working Group by Sean Vincent  
September 14, 2021



## My previous homework assignment

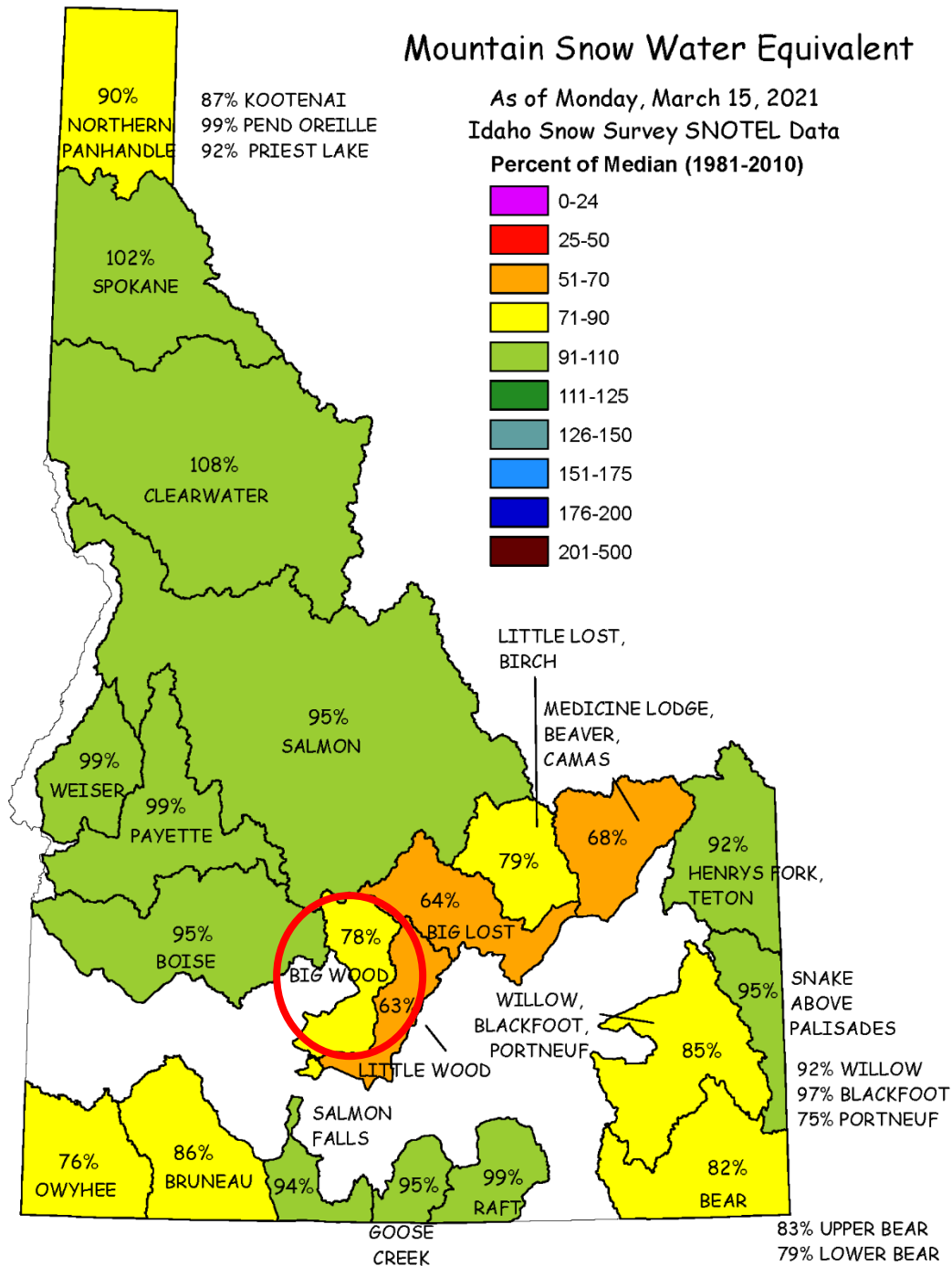
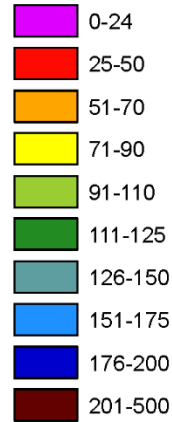
- Assess surface water availability this year for below Magic water users

## The first 3 tasks

1. Observe/look at current snowpack
  - Snow water content is below normal

# Mountain Snow Water Equivalent

As of Monday, March 15, 2021  
Idaho Snow Survey SNOTEL Data  
Percent of Median (1981-2010)

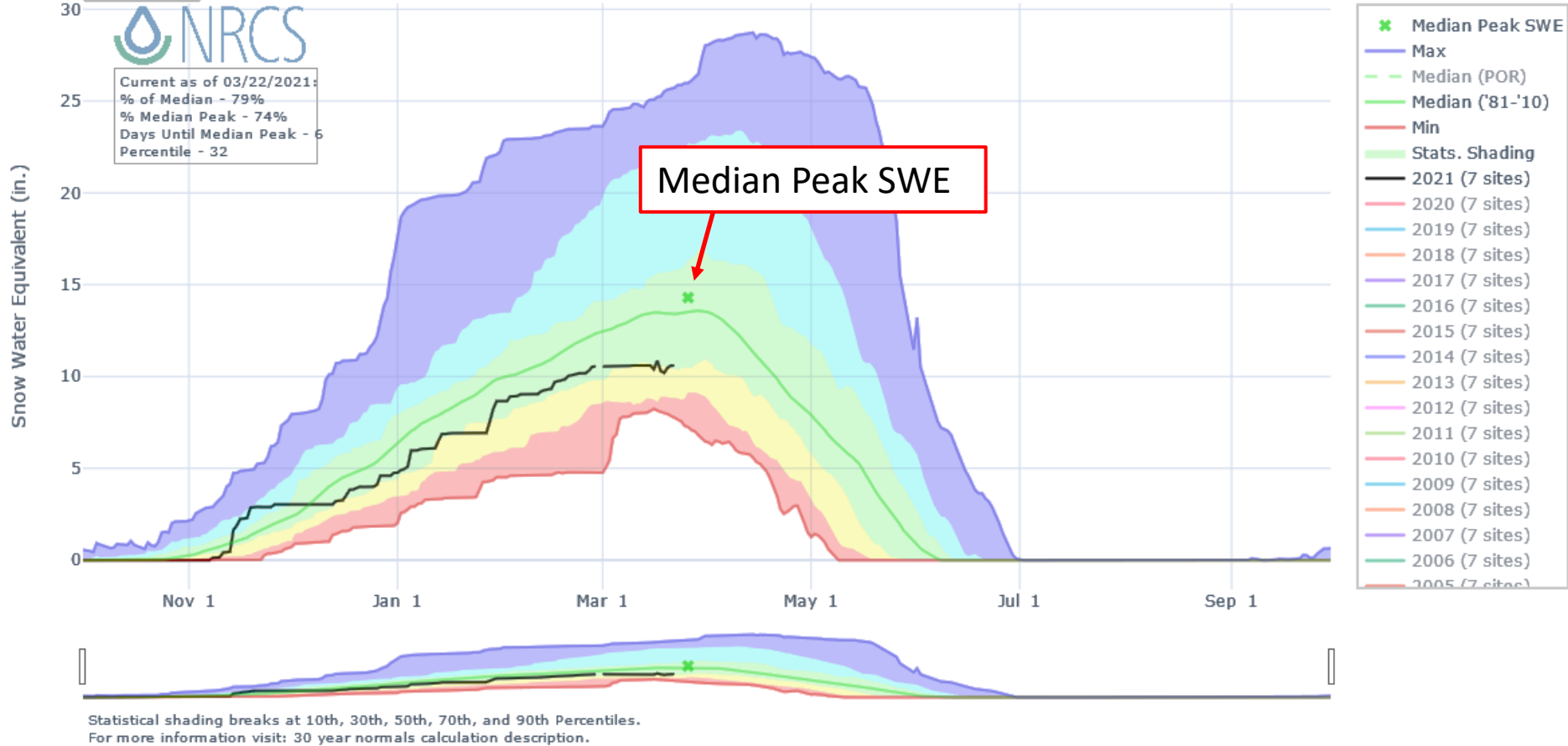


# SNOW WATER EQUIVALENT IN BIG WOOD

Reset Range

Link to data: CSV / JSON

Station List



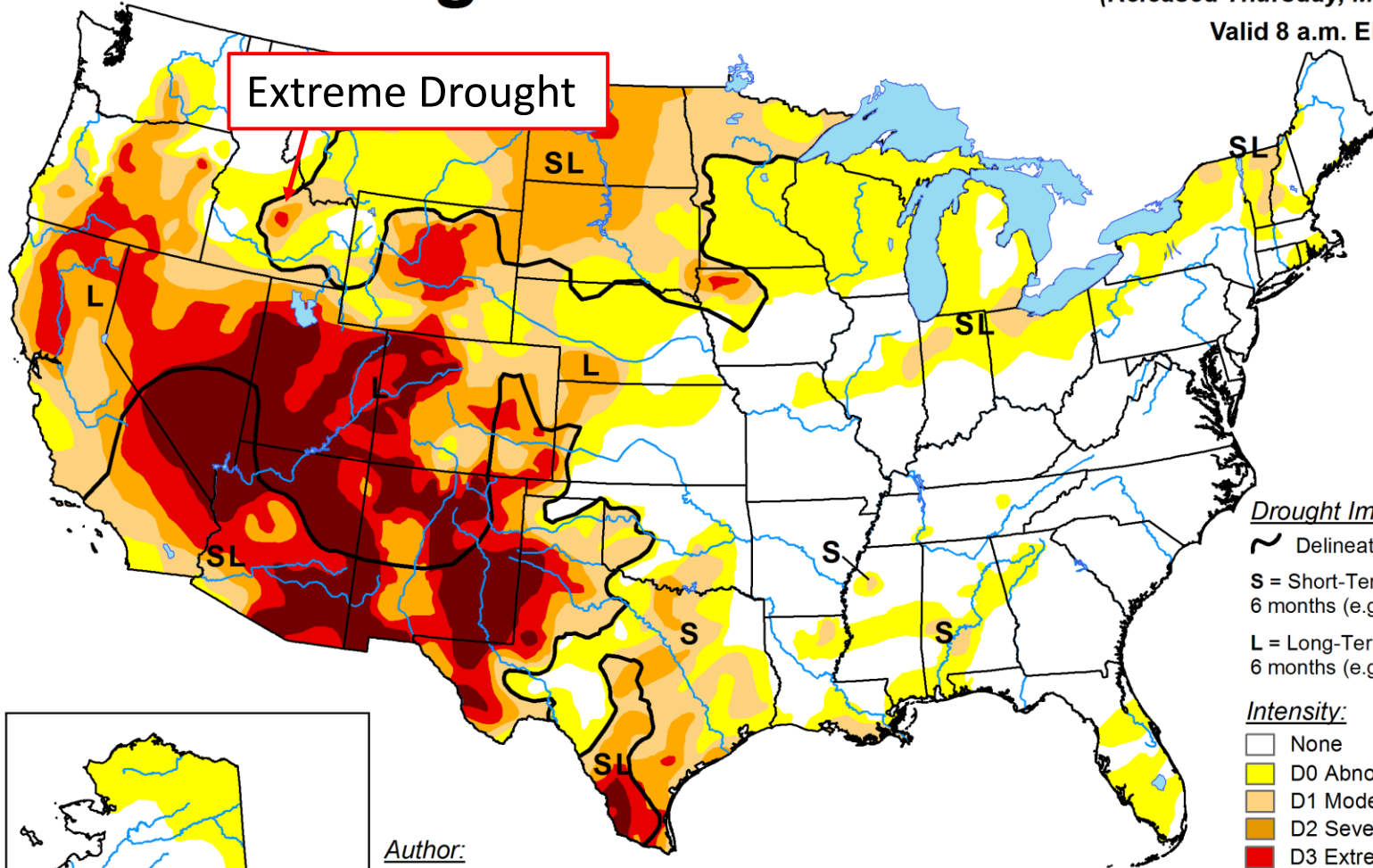


# U.S. Drought Monitor

March 16, 2021

(Released Thursday, Mar. 18, 2021)

Valid 8 a.m. EDT



## Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

## Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

Author:  
Brad Pugh  
CPC/NOAA

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>



[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

## The first 3 tasks

1. Observe/look at current snowpack
  - Snow water content is below normal
2. Observe/look at American Falls fill projections to determine if AFRD#2 will get a full allocation
  - American Falls projected to fill on April 1
  - Full allocation in 29 out of the last 30 years
3. Use Surface Water Supply Index to determine similar water supply years for Magic Reservoir water users
  - Analog years = 2002 and 2014

## SWSI

- Product of USDA Natural Resources Conservation Service
- Sum end of month reservoir storage and projected April-September streamflow
- Normalize forecasted volume with measured annual water supply volumes to put in historical context
  - SWSI ranges from -4.1 (extremely dry) to 4.1 (extremely wet) with median water supply year = 0.0
- SWSIs are computed at beginning of the month
  - SWSI tables for below Magic and above Hailey



## SWSI (cont'd)

- March SWSI uses end of February storage & April – September natural flow → good for historical context but doesn't include March storage changes
  - April volume = 7 KAF higher than March volume in 2002
  - April volume = 24 KAF higher in 2014
- SWSI tables include “adequate water supply” value for irrigation season
  - $\text{SWSI} > 0.4$  = adequate supply for Big Wood below Magic
  - SWSI for 50% exceedance forecast = -2.2 → most likely an inadequate 2021 surface water supply
  - SWSI for 10% exceedance forecast = 0.5

## SWSI (cont'd)

- According to Ron Abramovich (formerly with the NRCS)
  - Adequate water supply values were developed in consultation with irrigation entity representatives in the mid-90s
  - Lynn Harmon helped determine adequate water supply values for the Big Wood below Magic
  - Some of the values revised downward in 2011 based on increases in irrigation efficiency
    - Lynn Harmon indicated 275 KAF for Big Wood below Magic still valid/used
    - 275 KAF appears valid to me based on hydrographs for below Magic gage

## Big Wood River Basin SWSI

Adequate Water Supply Greater than 0.4 SWSI or 275 KAF

Station ID	Station Name	Period	Data Type	Years	# of Years		
13142500	Big Wood R blw Magic Reservoir	Apr-Sep	strm	1991-2020	30 Units KAF		
13142000	Magic Reservoir	28-Feb	resv	1991-2020	30 Units KAF		
ENSO Classification							
SE Strong El Nino - EN Mild El Nino - N Neutral - LN Mild La Nina - SL Strong La Nina							
Rank	Year	Enso	Stream Flow Apr- Sep	Reservoir 28-Feb	Streamflow + Reservoir Sum	Non- Exceedance Probability	SWSI
1	2017	LN	710	99	808	97%	3.9
2	2006	N	636	62	699	94%	3.6
3	1997	N	605	78	683	90%	3.4
4	1998	SE	427	163	590	87%	3.1
5	1999	SL	420	120	540	84%	2.8
6	1995	SE	518	16	534	81%	2.6
7	2019	N	424	89	513	77%	2.3
8	1996	N	351	127	478	74%	2.0
9	2011	SL	322	91	412	71%	1.7
10	2018	LN	204	171	375	68%	1.5
11	1993	EN	355	14	369	65%	1.2
12	2012	LN	238	128	365	61%	0.9
13	2000	N	165	111	277	58%	0.7
2021 10% Chance Exceedance Forecast		?	240	27	267	56%	0.5
14	2010	EN	167	82	250	55%	0.4
15	2009	N	219	30	249	52%	0.1
16	2016	SE	187	36	223	48%	-0.1
17	2005	EN	194	26	219	45%	-0.4
18	2008	N	178	24	202	42%	-0.7
19	2020	?	56	135	190	39%	-0.9
2021 30% Chance Exceedance Forecast		?	158	27	185	37%	-1.1
20	2007	EN	60	124	184	35%	-1.2
21	2003	EN	140	23	163	32%	-1.5
22	2015	EN	79	61	140	29%	-1.7
23	2002	N	120	19	139	26%	-2.0
2021 50% Chance Exceedance Forecast		?	112	27	139	24%	-2.2
24	2014	N	84	49	133	23%	-2.3
25	1994	SE	31	86	117	19%	-2.6
2021 70% Chance Exceedance Forecast		?	74	27	101	18%	-2.7
26	1991	N	76	22	98	16%	-2.8
27	2013	N	66	28	93	13%	-3.1
28	2004	N	66	23	89	10%	-3.4
29	2001	LN	38	48	87	6%	-3.6
2021 90% Chance Exceedance Forecast		?	32	27	59	5%	-3.8
30	1992	EN	24	27	51	3%	-3.9

Station ID	Station Name	Period	Data Type	Years	# of Years
13142500	Big Wood R blw Magic Reservoir	May-Sep	strm	1991-2020	30 Units KAF
13142000	Magic Reservoir	30-Apr	resv	1991-2020	30 Units KAF

## ENSO Classification

SE Strong El Nino - EN Mild El Nino - N Neutral - LN Mild La Nina - SL Strong La Nina

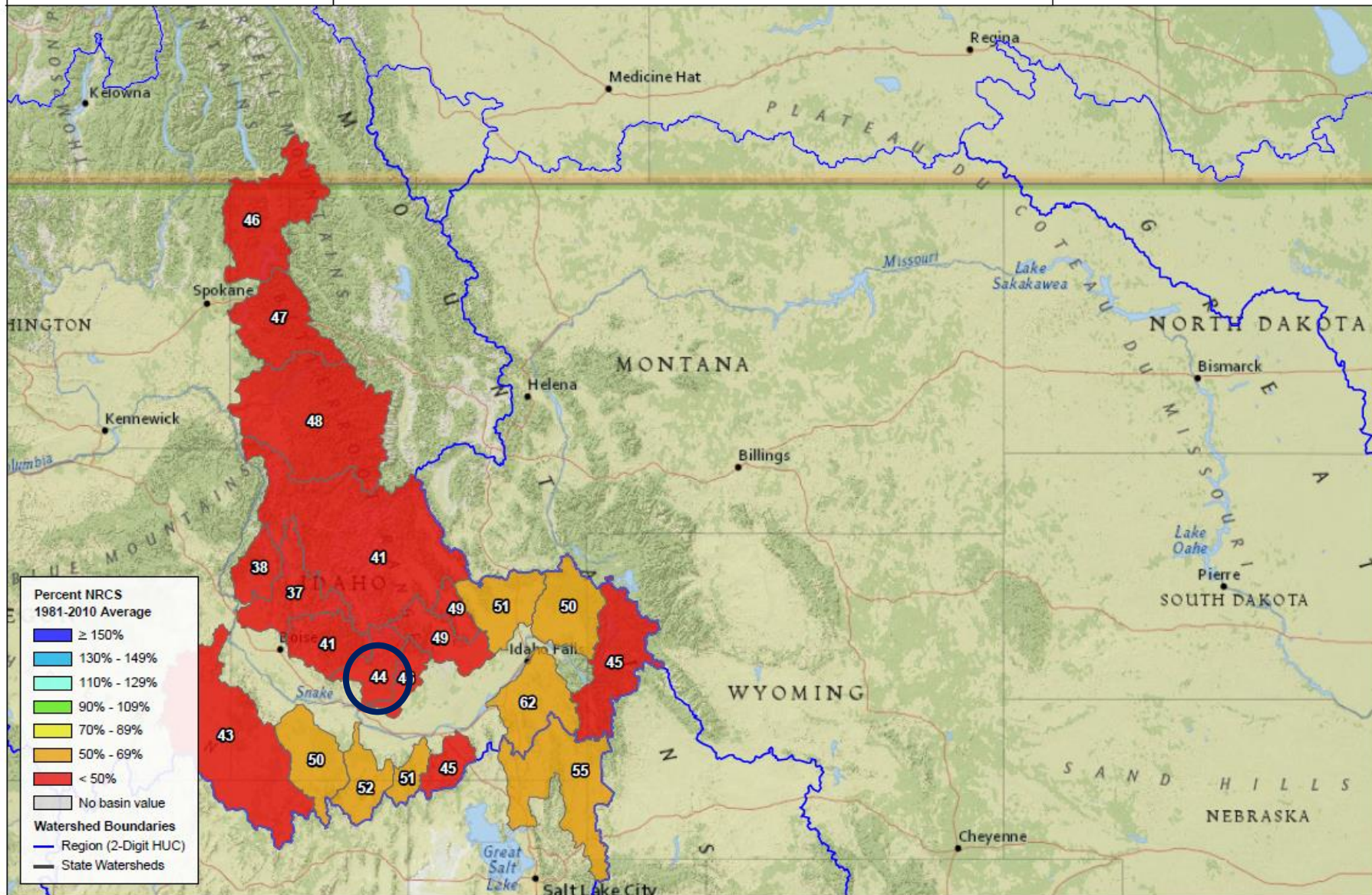
Rank	Year	Enso	Stream Flow May- Sep	Reservoir 30-Apr	Streamflow + Reservoir Sum	Non- Exceedance Probability	SWSI
1	2017	LN	514	182	696	97%	3.9
2	1997	N	438	180	618	94%	3.6
3	1995	SE	434	152	585	90%	3.4
4	2006	N	387	183	570	87%	3.1
5	1998	SE	346	184	530	84%	2.8
6	1999	SL	298	180	478	81%	2.6
7	2019	N	276	182	459	77%	2.3
8	1996	N	267	169	436	74%	2.0
9	2011	SL	234	176	410	71%	1.7
10	1993	EN	250	142	392	68%	1.5
11	2018	LN	161	193	353	65%	1.2
12	2012	LN	139	188	327	61%	0.9
13	2000	N	95	189	284	58%	0.7
14	2016	SE	117	157	274	55%	0.4
15	2009	N	175	86	261	52%	0.1
16	2010	EN	124	135	259	48%	-0.1
17	2005	EN	176	54	230	45%	-0.4
18	2007	EN	43	167	210	42%	-0.7
19	2008	N	144	62	205	39%	-0.9
20	2020	?	43	158	201	35%	-1.2
21	2003	EN	119	57	176	32%	-1.5
22	2014	N	61	94	156	29%	-1.7
23	2002	N	65	81	146	26%	-2.0
24	2015	EN	62	83	145	23%	-2.3
25	1994	SE	25	100	124	19%	-2.6
26	2004	N	34	76	110	16%	-2.8
27	2013	N	51	55	106	13%	-3.1
28	2001	LN	26	78	104	10%	-3.4
29	1991	N	71	32	103	6%	-3.6
2021 10% Chance Exceedance Forecast		?	43	42	85	6%	-3.7
2021 20% Chance Exceedance Forecast		?	25	42	67	5%	-3.8
2021 50% Chance Exceedance Forecast		?	15	42	58	4%	-3.8
30	1992	EN	17	40	56	3%	-3.9
2021 70% Chance Exceedance Forecast		?	8	42	50	2%	-4.0
2021 90% Chance Exceedance Forecast		?	2	42	44	1%	-4.1



61 day Precipitation

Percent NRCS 1981-2010 Average

March 1, 2021 - April 30, 2021





Big Wood above Hailey SWSI

Adequate Water Supply Greater than -2.8 SWSI or 135 KAF

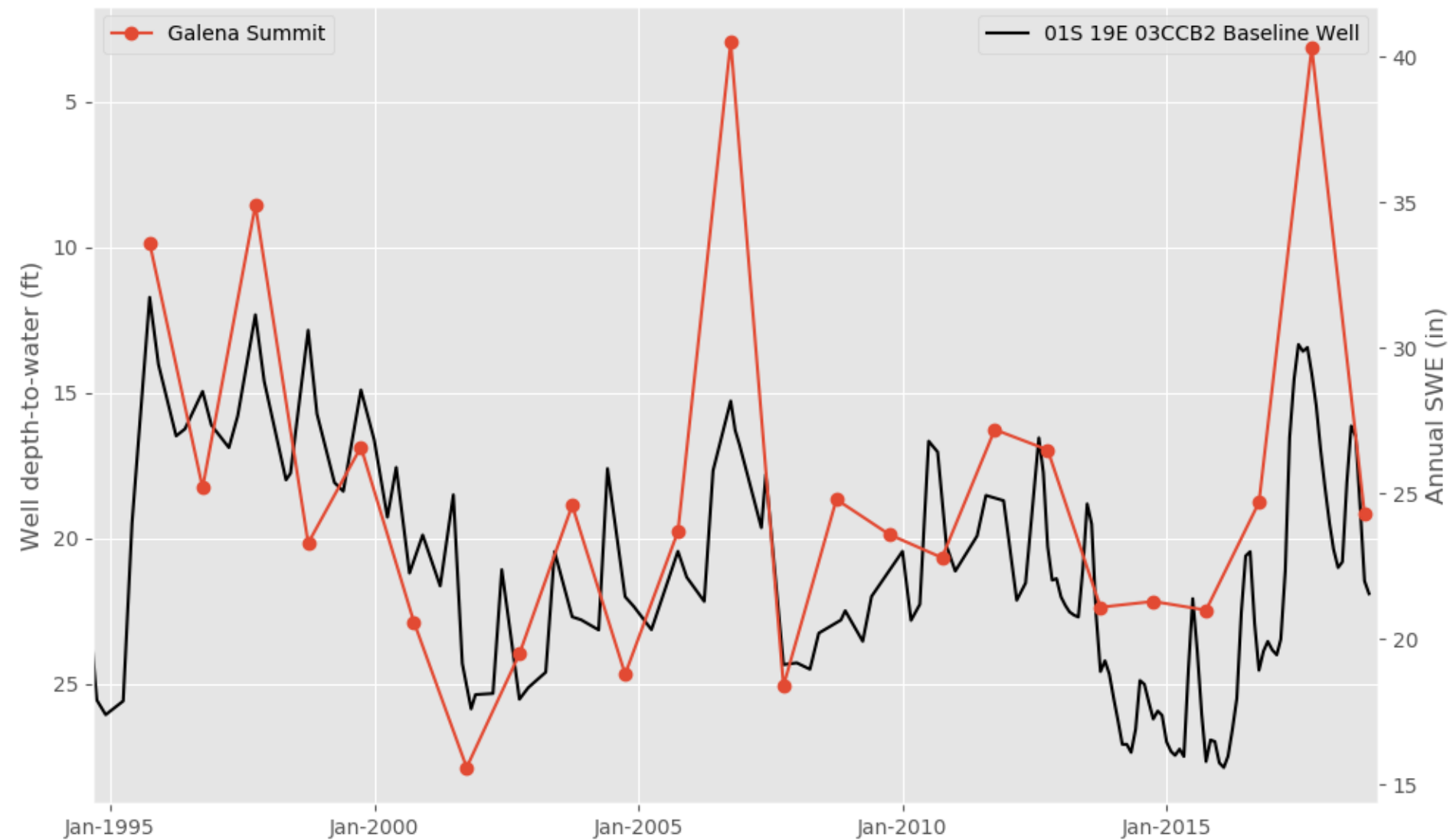
Station ID	Station Name	Period	Data Type	Years	# of Years		
13139510	Big Wood R at Hailey	Apr-Sep	strm	1991-2020	30 Units KAF		
ENSO Classification							
SE Strong El Nino - EN Mild El Nino - N Neutral - LN Mild La Nina - SL Strong La Nina							
Rank	Year	Enso	Stream Flow Apr- Sep	Reservoir 28- Feb	Streamflow + Reservoir Sum	Non- Exceedance Probability	SWSI
1	2017	LN	620	0	620	97%	3.9
2	1995	SE	501	0	501	94%	3.6
3	1997	N	500	0	500	90%	3.4
4	2006	N	480	0	480	87%	3.1
5	2019	EN	373	0	373	84%	2.8
6	1998	SE	366	0	366	81%	2.6
7	1993	EN	338	0	338	77%	2.3
8	1999	SL	335	0	335	74%	2.0
9	1996	N	334	0	334	71%	1.7
10	2011	SL	321	0	321	68%	1.5
11	2012	LN	272	0	272	65%	1.2
2021 10% Chance Exceedance Forecast		?	270	0	270	63%	1.1
12	2009	N	259	0	259	61%	0.9
13	2018	LN	257	0	257	58%	0.7
14	2005	EN	242	0	242	55%	0.4
15	2016	SE	236	0	236	52%	0.1
16	2010	EN	221	0	221	48%	-0.1
17	2003	EN	221	0	221	45%	-0.4
2021 30% Chance Exceedance Forecast		?	205	0	205	44%	-0.5
18	2008	N	199	0	199	42%	-0.7
19	2000	N	190	0	190	39%	-0.8
2021 50% Chance Exceedance Forecast		?	163	0	163	37%	-1.1
20	2014	N	162	0	162	35%	-1.2
21	2015	EN	159	0	159	32%	-1.5
22	2013	N	154	0	154	29%	-1.7
23	1991	N	153	0	153	26%	-2.0
24	2002	N	153	0	153	23%	-2.3
25	2004	N	136	0	136	19%	-2.6
26	2020	?	121	0	121	16%	-2.8
2021 70% Chance Exceedance Forecast		?	120	0	120	15%	-3.0
27	2007	EN	117	0	117	13%	-3.1
28	2001	LN	104	0	104	10%	-3.4
29	1992	EN	103	0	103	6%	-3.6
30	1994	SE	91	0	91	3%	-3.9
2021 90% Chance Exceedance Forecast		?	58	0	58	2%	-4.0

Station ID	Station Name	Period	Data Type	Years	# of Years		
13139510	Big Wood R at Hailey	Jun-Sep	strm	1991-2020	30 Units KAF		
ENSO Classification							
SE Strong El Nino - EN Mild El Nino - N Neutral - LN Mild La Nina - SL Strong La Nina							
Rank	Year	Enso	Stream Flow Jun- Sep	Reservoir 31- May	Streamflow + Reservoir Sum	Non- Exceedance Probability	SWSI
1	1995	SE	366	0	366	97%	3.9
2	2017	LN	326	0	326	94%	3.6
3	1997	N	289	0	289	90%	3.4
4	1998	SE	234	0	234	87%	3.1
5	2011	SL	231	0	231	84%	2.8
6	2006	N	219	0	219	81%	2.6
7	1999	SL	213	0	213	77%	2.3
8	2019	EN	212	0	212	74%	2.0
9	1996	N	206	0	206	71%	1.7
10	1993	EN	195	0	195	68%	1.5
11	2009	N	172	0	172	65%	1.2
12	2010	EN	164	0	164	61%	0.9
13	2005	EN	131	0	131	58%	0.7
14	2003	EN	128	0	128	55%	0.4
15	2012	LN	119	0	119	52%	0.1
16	2018	LN	118	0	118	48%	-0.1
17	2008	N	113	0	113	45%	-0.4
18	1991	N	112	0	112	42%	-0.7
19	2016	SE	105	0	105	39%	-0.9
20	2000	N	90	0	90	35%	-1.2
21	2014	N	83	0	83	32%	-1.5
22	2002	N	83	0	83	29%	-1.7
23	2015	EN	82	0	82	26%	-2.0
24	2013	N	82	0	82	23%	-2.3
25	2004	N	73	0	73	19%	-2.6
2021 10% Chance Exceedance Forecast		?	71	0	71	18%	-2.7
26	2020	?	64	0	64	16%	-2.8
27	2007	EN	51	0	51	13%	-3.1
2021 30% Chance Exceedance Forecast		?	48	0	48	11%	-3.2
28	2001	LN	47	0	47	10%	-3.4
29	1992	EN	44	0	44	6%	-3.6
30	1994	SE	44	0	44	3%	-3.8
2021 50% Chance Exceedance Forecast		?	32	0	32	2%	-4.0
2021 70% Chance Exceedance Forecast		?	16	0	16	2%	-4.0
2021 90% Chance Exceedance Forecast		?	7	0	7	1%	-4.1

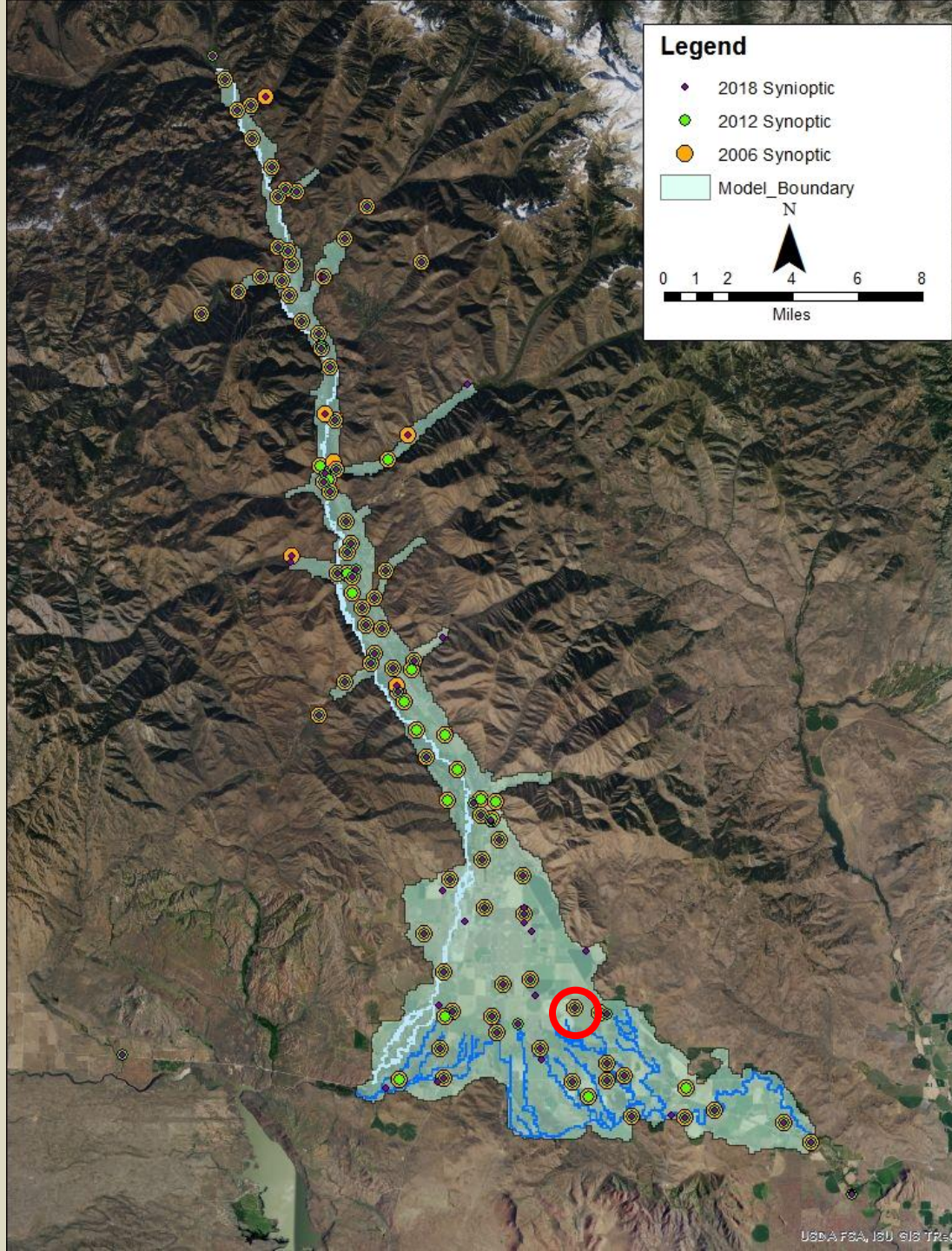
## Application of Big Wood SWSI for Silver Creek?

- No SWSI for Silver Creek
- Silver Creek is spring fed, not snowmelt runoff
- Shallow aquifer responds quickly to snowmelt
  - Permeable and relatively small

# Groundwater levels track snowpack







### Legend

2018 Synoptic

2012 Synoptic

2006 Synoptic

Model\_Boundary

N

0 1 2 4 6 8

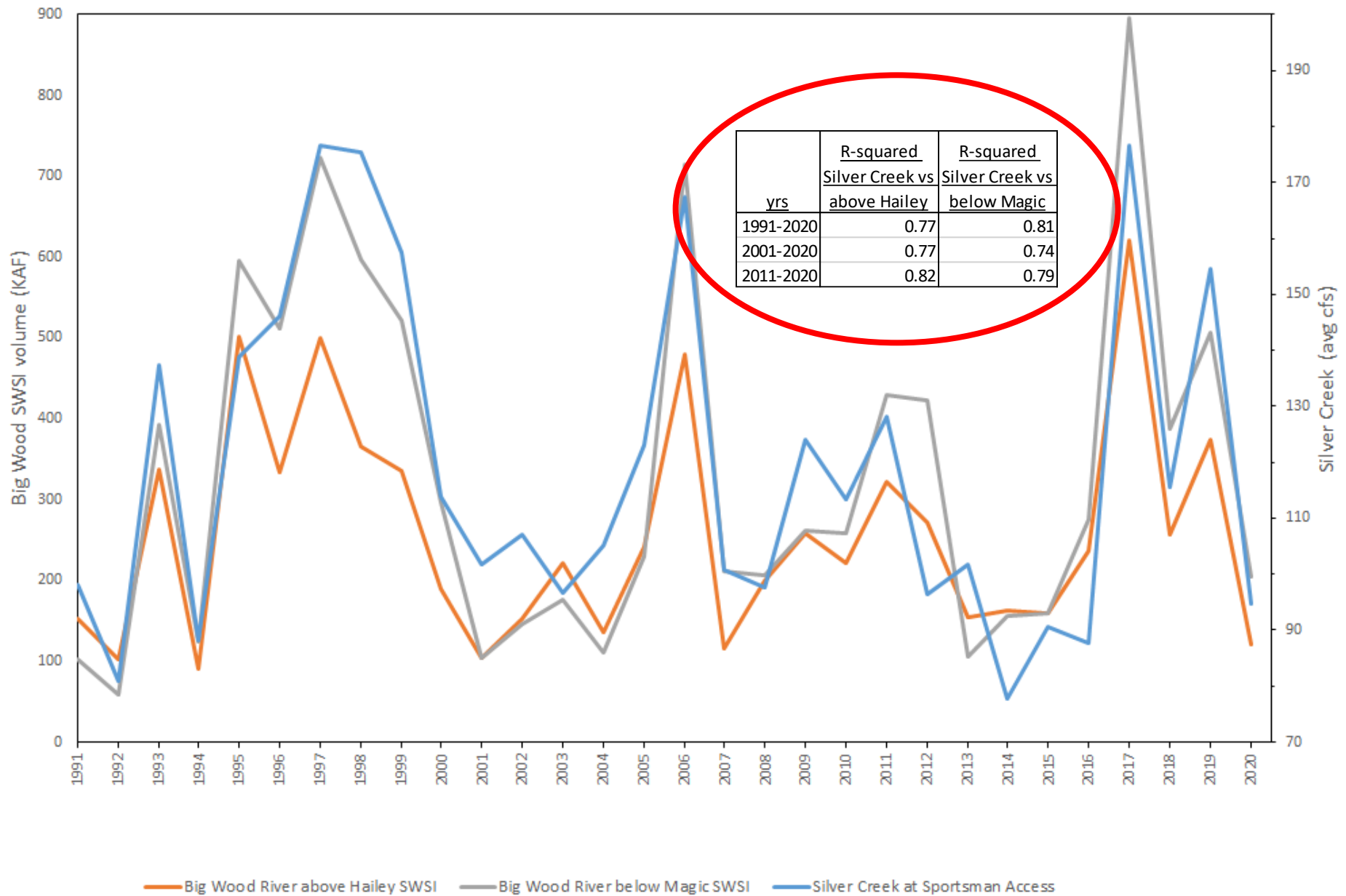
Miles



## Application of Big Wood SWSI for Silver Creek?

- No SWSI for Silver Creek
- Silver Creek is spring fed, not snowmelt runoff
- Shallow aquifer responds quickly to snowmelt
  - Permeable and relatively small
- Correlation between Big Wood River above Hailey SWSI and irrigation season flow in Silver Creek is relatively high

# April - September Surface Water Supply



## Big Wood River Basin SWSI

Adequate Water Supply Greater than -0.8 SWSI or 275 KAF

Station ID	Station Name	Period	Data Type	Years	# of Years
13142500	Big Wood R blw Magic Reservoir	Apr-Sep	strm	1917-2020	104 Units KAF
13142000	Magic Reservoir	31-Mar	resv	1917-2020	104 Units KAF
ENSO Classification					
SE Strong El Nino - EN Mild El Nino - N Neutral - LN Mild La Nina - SL Strong La Nina					

Rank	Year	Enso	Stream Flow Apr- Sep	Reservoir 31-Mar	Streamflow + Reservoir Sum	Non- Exceedance Probability	SWSI
1	2017	LN	710	186	896	99%	4.1
2	1983	SE	747	114	861	98%	4.0
3	1965	#N/A	688	142	830	97%	3.9
4	1943	#N/A	686	81	767	96%	3.8
5	1952	#N/A	697	45	742	95%	3.8
6	1982	N	622	108	729	94%	3.7
7	1997	N	605	118	724	93%	3.6
8	1971	LN	624	97	721	92%	3.5
9	1969	#N/A	654	63	716	91%	3.5
10	2006	N	636	78	714	90%	3.4
11	1984	N	545	149	694	90%	3.3
12	1938	#N/A	586	84	670	89%	3.2
13	1974	SL	488	146	634	88%	3.1
14	1986	N	432	186	619	87%	3.1
15	1998	SE	427	170	597	86%	3.0
16	1995	SE	518	77	595	85%	2.9
17	1958	#N/A	456	133	589	84%	2.8
18	1956	#N/A	503	78	581	83%	2.7
19	1975	LN	443	124	567	82%	2.7
20	1951	#N/A	414	128	542	81%	2.6
21	1917	#N/A	479	56	535	80%	2.5
22	1999	SL	420	102	522	79%	2.4
23	1996	N	351	161	512	78%	2.3
24	2019	N	424	83	507	77%	2.3
25	1957	#N/A	316	182	498	76%	2.2
26	1922	#N/A	421	71	492	75%	2.1
27	1921	#N/A	429	58	487	74%	2.0



# Questions?

