



IDAHO
EPSCoR



Experimental Program to Stimulate Competitive Research

“How Dry is Dry?”

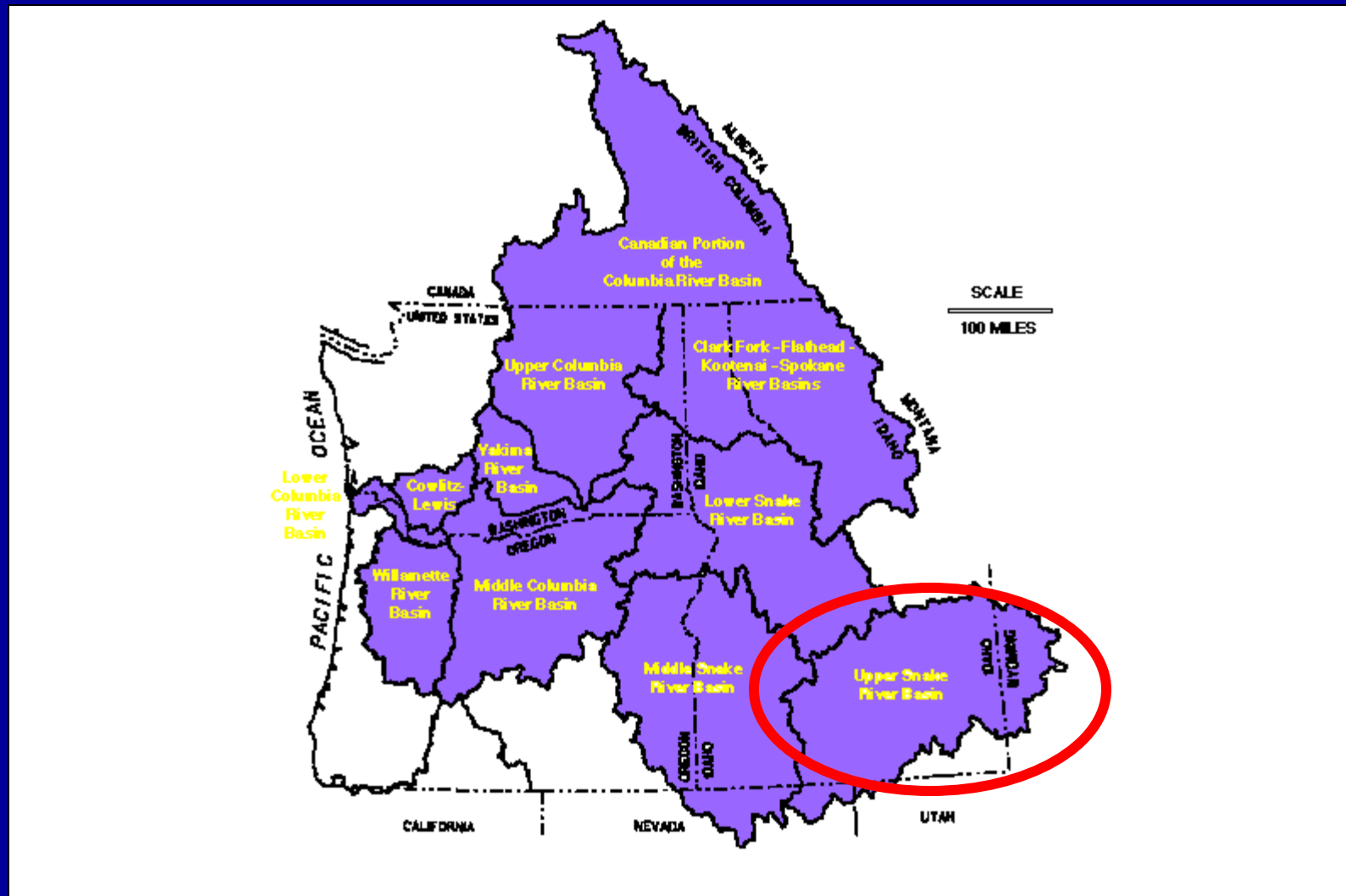
Assessing Climate Change Impacts on Water Rights

Michael Frey

Climate Change/Water Right Questions

- How will Climate change scenarios affect water Right allocation on the Snake River Plain?
- **How to target model Wet, Dry Years?**
- How will Farmers react to a 5 - 10 % shift in water availability?
- What are the economic affects of this shift?

AOC: Upper Snake River Basin

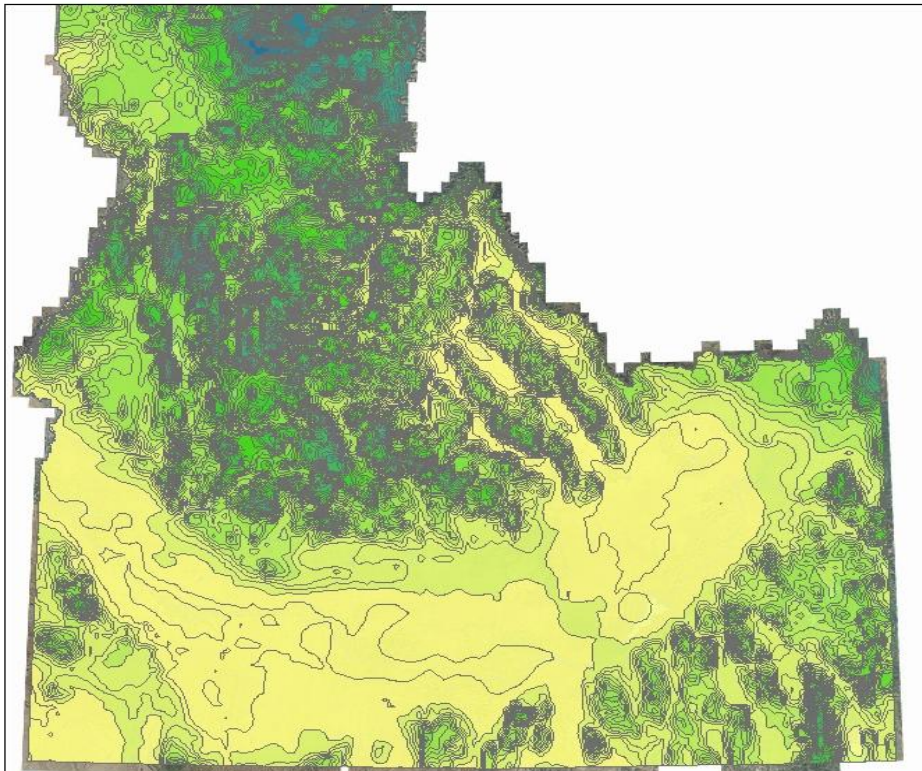


Phase 1 Target model years: What is a wet or dry year?

Indices

- **PRISM Precipitation**
- **Surface Water Supply Index**
- **Palmer Drought Index**
- **SNOTEL**

Idaho Average Annual Precipitation



Legend

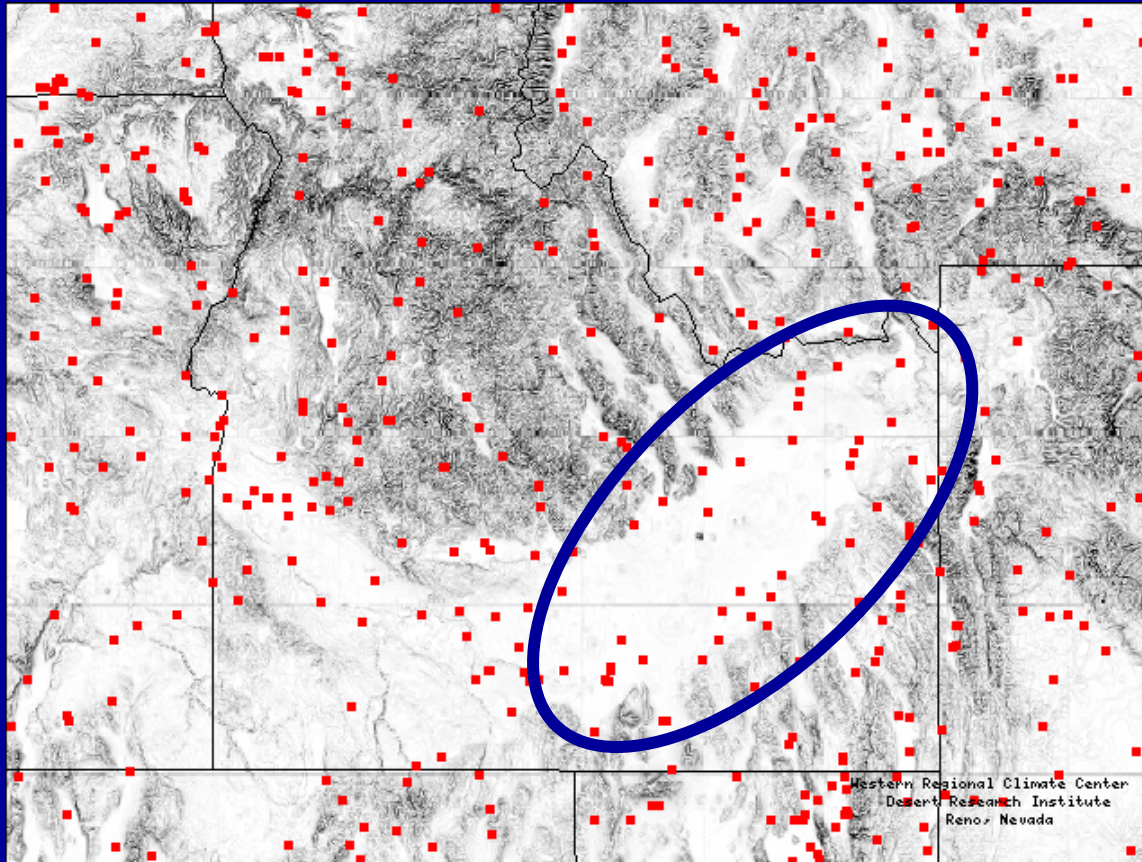
annual_precip

RANGE

7.000000 - 11.000000	31.000001 - 35.000000	63.000001 - 67.000000
11.000001 - 17.000000	35.000001 - 39.000000	67.000001 - 73.000000
17.000001 - 21.000000	39.000001 - 43.000000	73.000001 - 77.000000
21.000001 - 27.000000	43.000001 - 47.000000	77.000001 - 83.000000
27.000001 - 31.000000	47.000001 - 53.000000	83.000001 - 87.000000
	53.000001 - 57.000000	87.000001 - 93.000000
	57.000001 - 63.000000	93.000001 - 97.000000

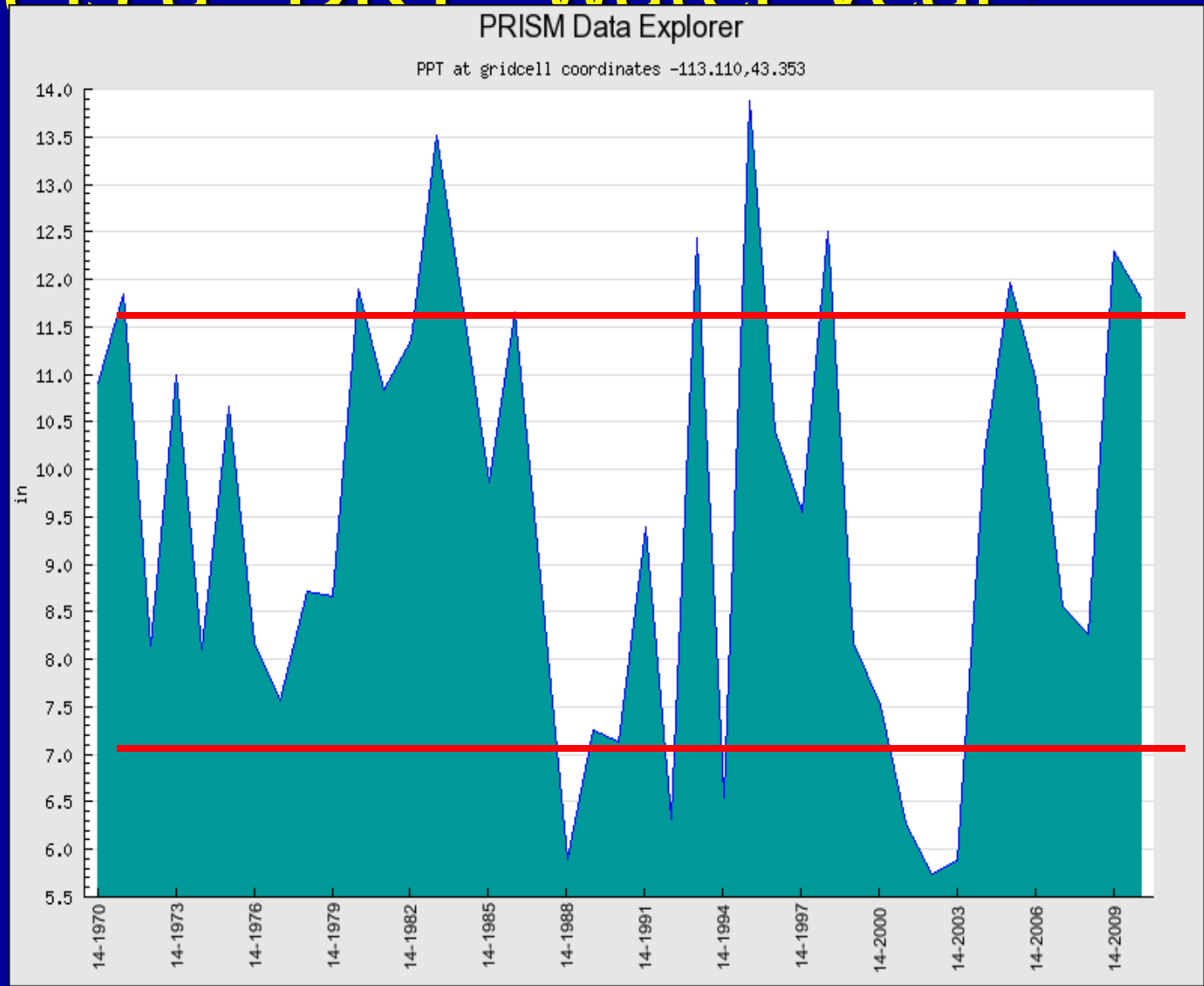
Precipitation Collection Stations

Western Regional Climate Center
Desert Research Institute Reno, Nevada



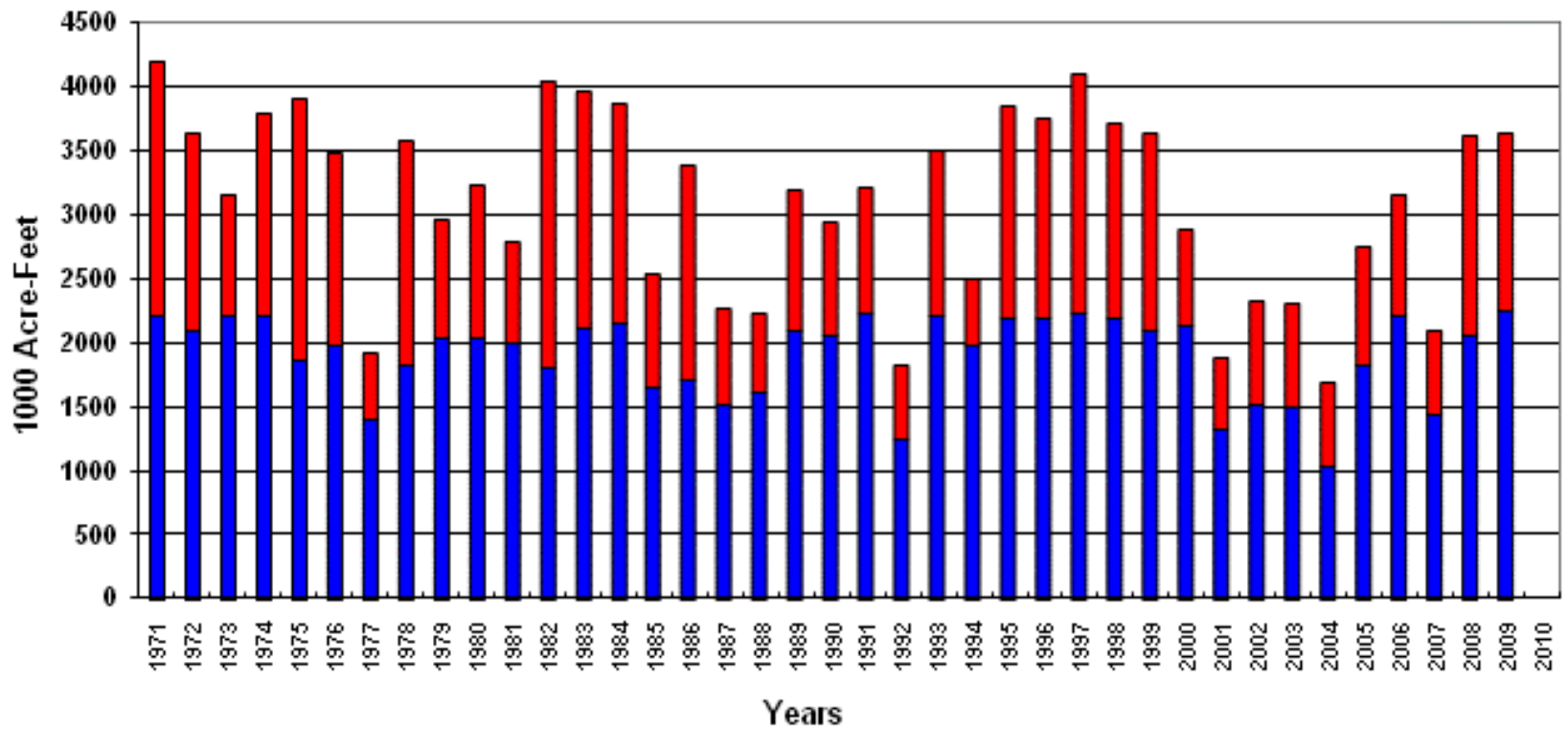
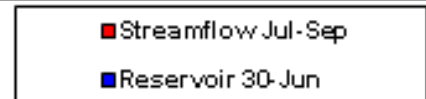
What is a "DRY" water year?

- Mean
9.57
- Stdev.
2.27



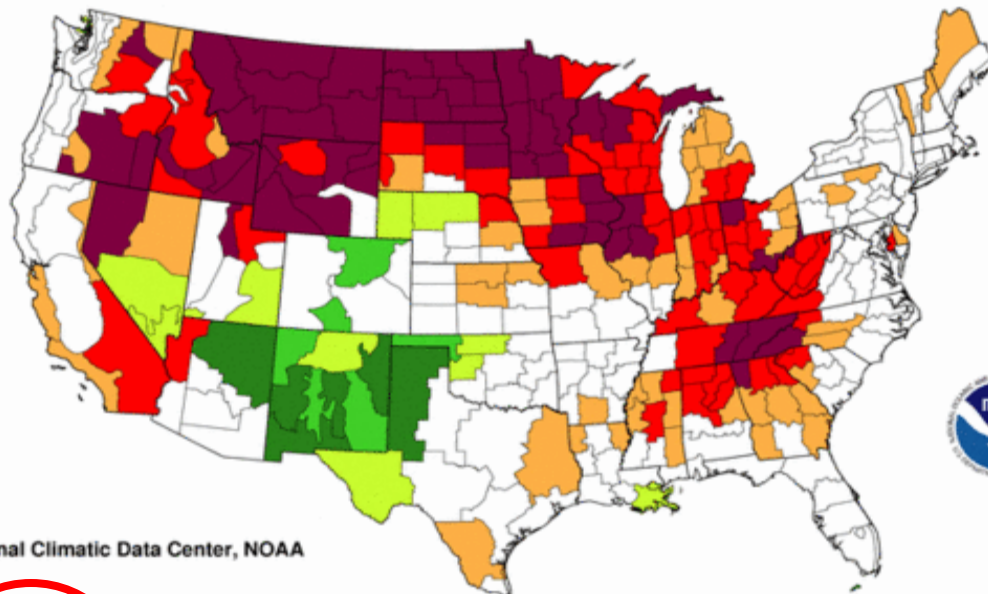
SWSI

July 1 Surface Water Supply Index (SWSI)
Snake River near Heise & Jackson and Palisades Reservoirs



Palmer indices

Palmer Hydrological Drought Index
July, 1988

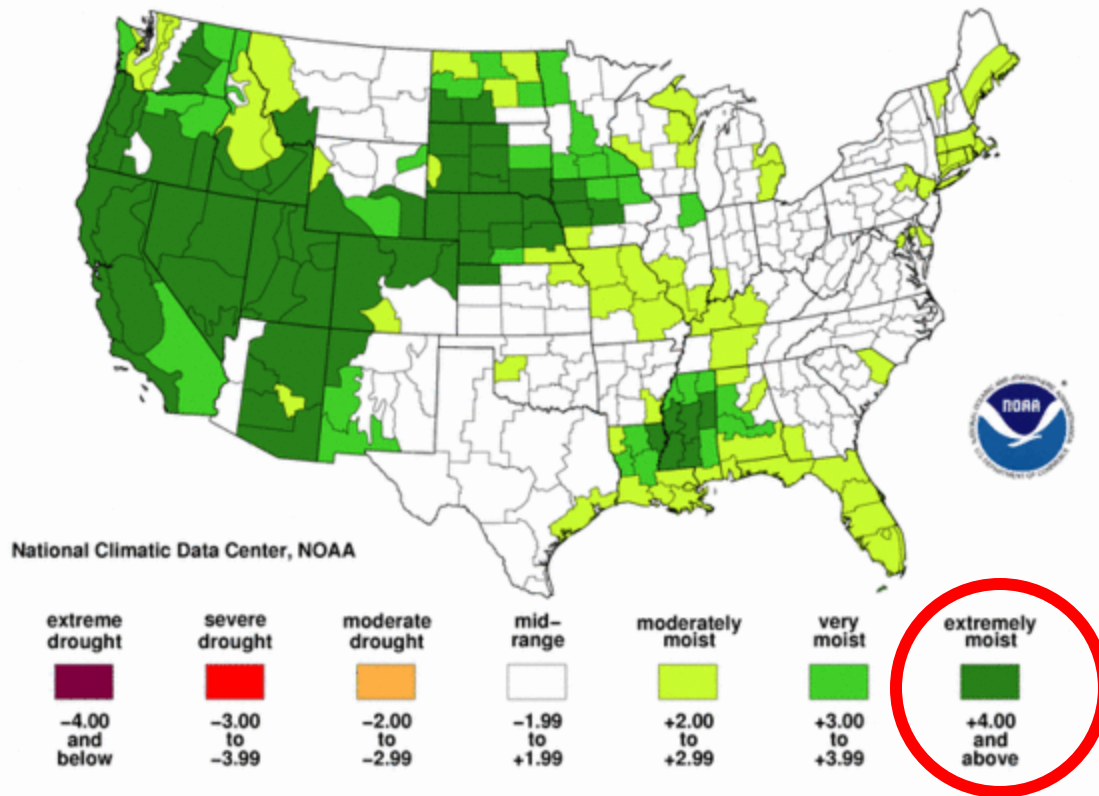


National Climatic Data Center, NOAA



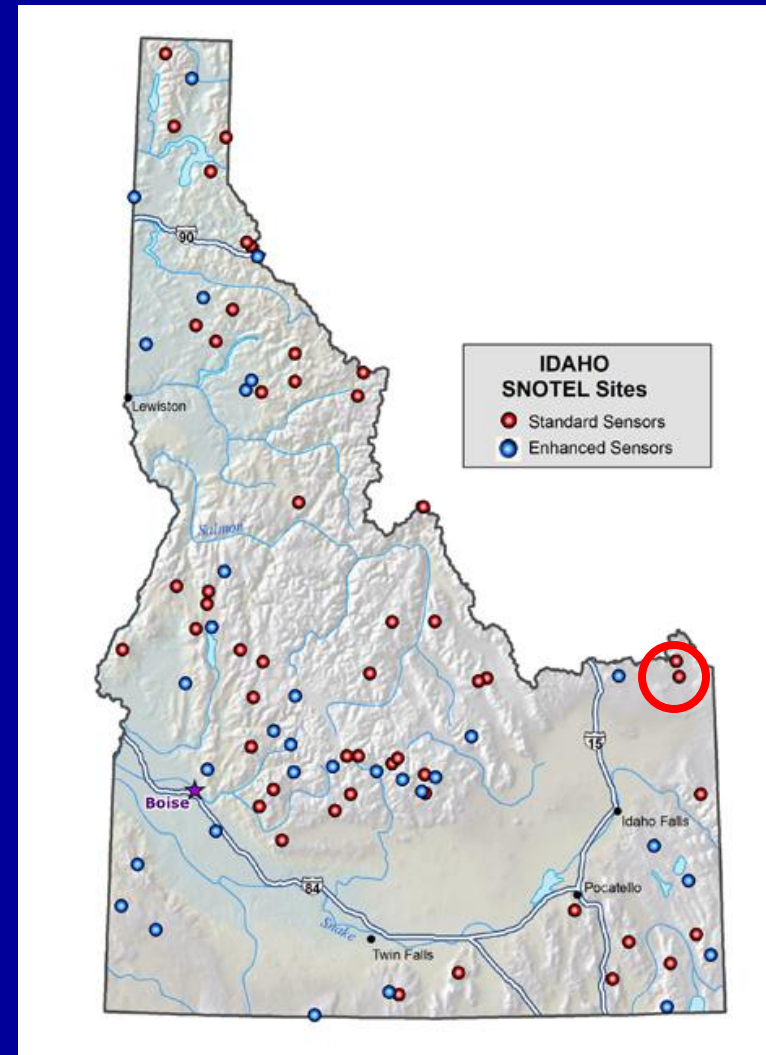
Palmer Indices

Palmer Hydrological Drought Index
July, 1983



SNOTEL/ White Elephant Site

- April 1st
Forecasting for
the coming
water Year

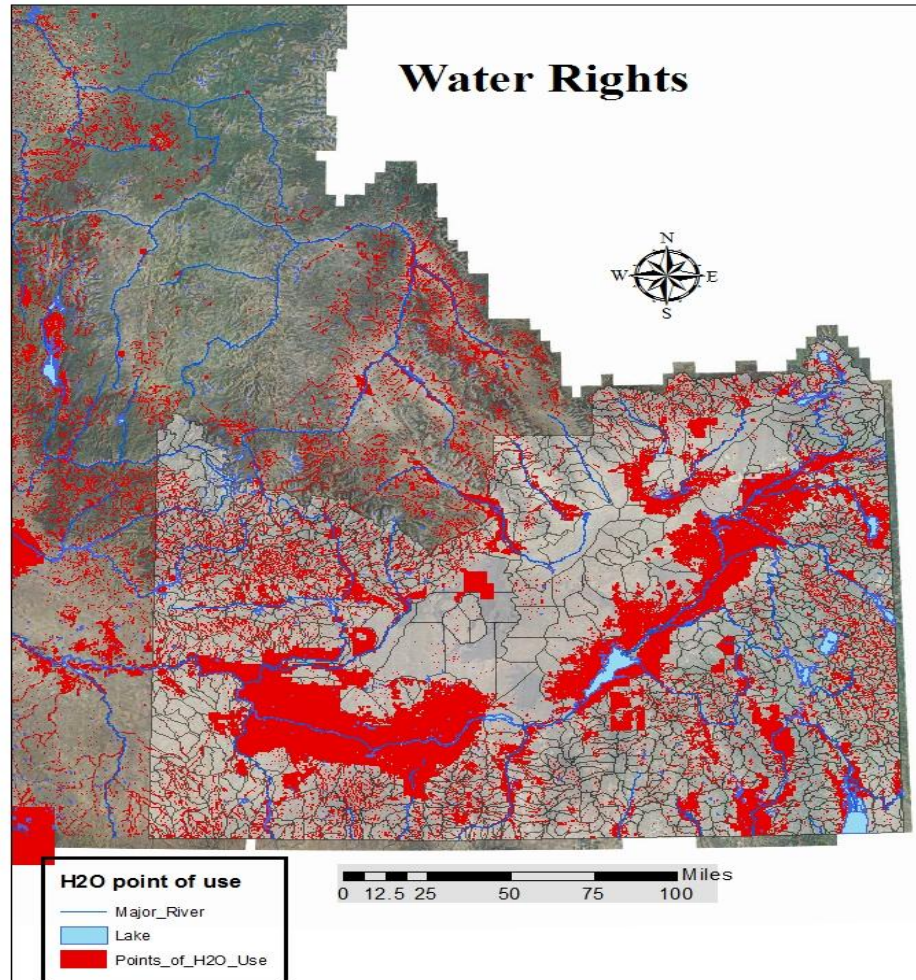


Target Years

- **Wet Years-**
 - 1983, 1997,
2006
- **Dry Years**
 - 1988, 1992,
2002

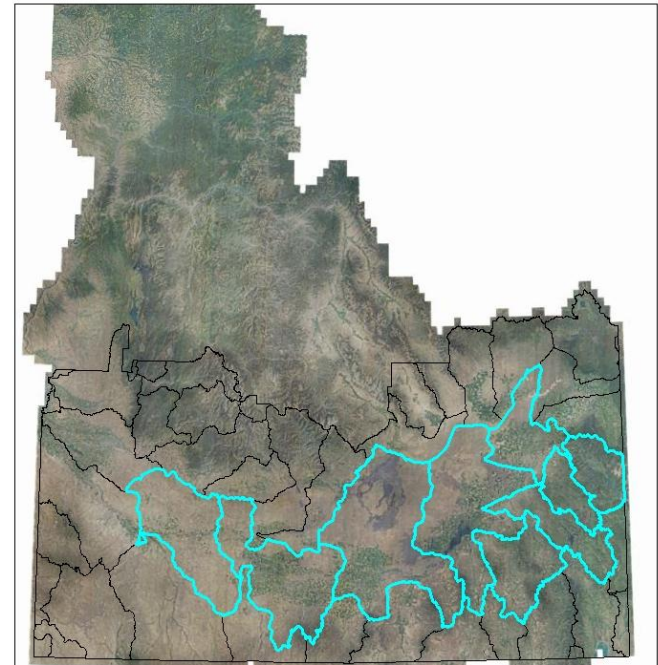


WATER RIGHTS SNAKE RIVER



Water District 1

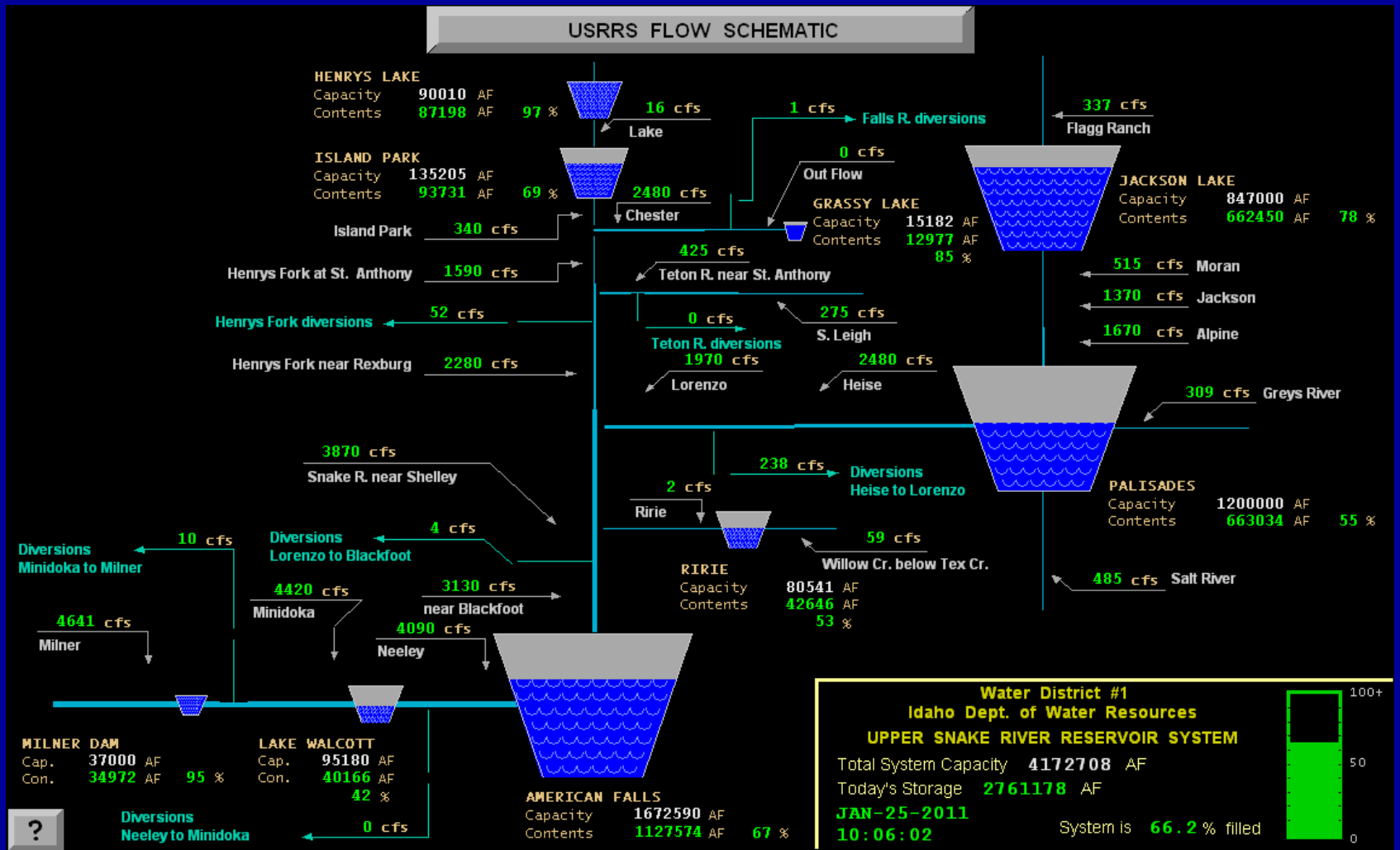
- District 1
- Henry's Lake to Minidoka
- Agricultural land use



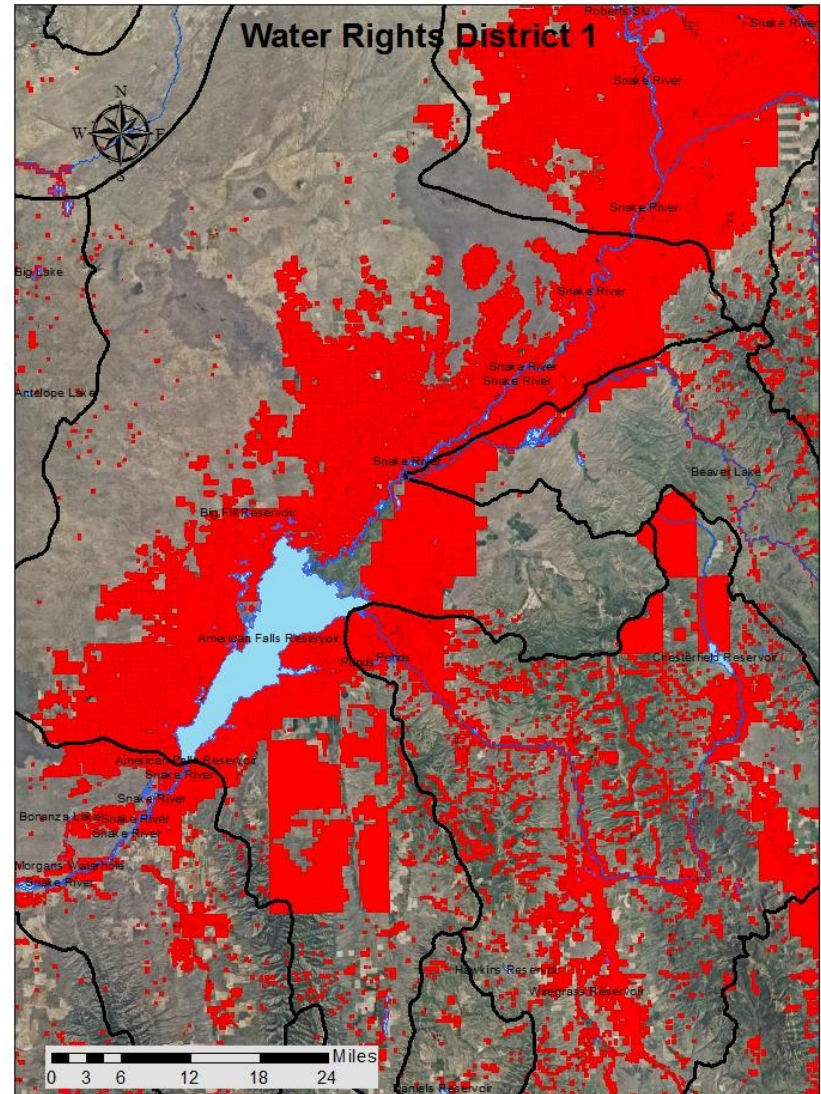
0 15 30 60 90 120
Miles

Water District 1

Water District One Flow Schematic



- Daily Accounting data
- Water lease and Rental information after cut off
- Use District 1 data as model



Daily accounting data

WATER DISTRICT 01 - SNAKE RIVER FLOW ACCOUNTING - MAR 1, 1992

17-FEB-93

REACH FLOWS IN CFS	ACTUAL DATE	NATURAL FLOW	ACTUAL FLOW	REMAINING NAT FLOW	POWER FLOW	STORED FLOW	RESRVOIR EVAP	NATURAL FLOW DIV	TOTAL RCH DIV	REACH GAIN	LAST POINT
1 TO MORAN	FEB 25	425.	425.	0.	0.	425.	0.	425.	0.	425.	9060823
33 MORAN TO ALPINE	FEB 25	1500.	1500.	1075.	0.	425.	0.	0.	0.	1075.	19210331
34 SALT RIVER ABV RES	FEB 25	406.	406.	406.	0.	0.	0.	0.	0.	406.	19210331
35 GREYS RIVER ABV RES	FEB 25	179.	179.	179.	0.	0.	0.	0.	0.	179.	19210331
2 ALPINE TO IRWIN	FEB 26	2246.	1100.	1821.	0.	-721.	0.	0.	0.	161.	19210331
3 IRWIN TO HEISE	FEB 26	2546.	1400.	2121.	0.	-721.	0.	0.	0.	300.	19210331
4 HEISE TO BLW DRY BED	* FEB 26	2546.	1079.	2121.	0.	-1042.	0.	0.	0.	0.	19210331
32 BLW DRY BED TO LORENZO	FEB 26	1989.	540.	1564.	0.	-1024.	0.	0.	0.	-557.	19210331
11 TO HENRYS LAKE	FEB 23	45.	10.	0.	0.	10.	0.	45.	0.	45.	19170515
12 HENRYS L TO ISLAND PARK	FEB 24	440.	253.	394.	0.	-141.	0.	0.	0.	394.	19210331
13 ISLAND PARK TO ASHTON	FEB 25	1207.	1020.	1161.	0.	-141.	0.	0.	0.	76.	19210331
30 ASHTON TO AB FALLS RIVER	* FEB 25	1207.	1015.	1156.	0.	-141.	0.	5.	5.	5.	19210331
14 TO GRASSY LAKE	FEB 25	5.	0.	5.	0.	-5.	0.	0.	0.	5.	19210331
15 GRASSY LAKE TO SQUIRREL	FEB 25	363.	358.	363.	0.	-5.	0.	0.	0.	363.	19210331
16 SQUIRREL TO CHESTER	FEB 25	445.	420.	425.	0.	-5.	0.	20.	20.	425.	19210331
17 AB FALLS R TO ST ANTHONY	FEB 25	1608.	1340.	1511.	0.	-171.	0.	26.	26.	144.	19210331
10 ST ANTHONY TO AB NF TETN	* FEB 25	1608.	1243.	1414.	0.	-171.	0.	97.	97.	0.	19210331
18 AB S LEIGH TO ST ANTHONY	FEB 25	397.	397.	397.	0.	0.	0.	0.	0.	397.	19210331
19 ST ANTHONY TO TETON MTH	* FEB 25	397.	388.	388.	0.	0.	0.	9.	9.	0.	19210331
20 AB NF TETN TO REXBURG	FEB 26	2111.	1620.	1909.	0.	-289.	0.	0.	0.	177.	19210331
21 LORENZO TO MENAN	* FEB 26	4101.	2160.	3474.	0.	-1314.	0.	0.	0.	0.	19210331
5 MENAN TO NR IDAHO FALLS	FEB 26	3600.	2080.	2973.	0.	-893.	0.	0.	0.	-511.	19210331
36 NR ID FALLS TO AB WLW CR	* FEB 26	3600.	2080.	2973.	0.	-893.	0.	0.	0.	0.	19210331
23 WILLOW CRK BLW TEX CREEK	FEB 26	40.	40.	40.	0.	0.	0.	0.	0.	40.	19210331
24 BLW TEX CREEK TO NR RIRI	FEB 26	40.	0.	40.	0.	-40.	0.	0.	0.	0.	19210331
25 NR RIRIE TO FDWY NR UCON	FEB 26	40.	0.	40.	0.	-40.	0.	0.	0.	0.	19210331
28 FDWY NR UCON TO END	* FEB 26	40.	0.	40.	0.	-40.	0.	0.	0.	0.	19210331
31 WILLOW CRK TO SHELLEY	FEB 27	3808.	2200.	3180.	0.	-980.	0.	0.	0.	1608.	19210331
6 SHELLEY TO AT BLACKFOOT	FEB 27	3620.	1940.	2993.	0.	-1053.	0.	0.	0.	-188.	19210331
22 AT BLKFOOT TO BLW BLKFT	* FEB 27	3620.	1940.	2993.	0.	-1053.	0.	0.	0.	0.	19210331
38 BLW BLKFT TO NR BLKFOOT	FEB 28	3465.	1830.	2838.	0.	-1008.	0.	0.	0.	-155.	19210331
39 PORTNUEF R AT POCATELLO	FEB 28	265.	265.	265.	0.	0.	0.	0.	0.	265.	19210331
7 NR BLACKFOOT TO NEELEY	FEB 29	6035.	326.	306.	0.	20.	0.	5102.	0.	2305.	19210331
8 NEELEY TO MINIDOKA	FEB 29	6134.	405.	0.	405.	0.	0.	0.	0.	99.	19210331
9 MINIDOKA TO MILNER	MAR 1	6327.	583.	598.	0.	-15.	0.	0.	0.	193.	19991231

* - INDICATES FLOW ESTIMATED, NOT MEASURED

TOTALS 5729. 157. 6327.

RESERVOIR	PREVIOUS AF	CURRNT AF	CHNG CFS	ACCRD CFS	TOTAL AF	EVAP AF	PRIORITY	RESERVOIR	AF RIGHT	AF STORED
1 JACKSON LAKE	639800.0	639500.0	-151.2	425.0	698600.0	0.0	1	JACKSON LAKE	298981.0	253445.6
2 PALISADES	740000.0	742400.0	1210.0	0.0	809593.8	0.0	2	LAKE WALCOTT	97000.0	97000.0
3 HENRYS LAKE	83060.0	83120.0	30.2	45.2	41945.2	0.0	3	JACKSON LAKE	138829.0	138829.0
4 ISLAND PARK	100200.0	100400.0	100.8	0.0	87268.8	0.0	4	JACKSON LAKE	409190.0	306325.4
5 GRASSY LAKE	12040.0	12050.0	5.0	0.0	0.0	0.0	5	HENRYS LAKE	79350.0	31295.2
6 RIRIE	42750.0	42820.0	35.3	0.0	1122.6	0.0	6	PALISADES	259600.0	259600.0
7 AMERICAN FALLS	1270600.0	1279300.0	4386.2	5102.2	1159384.7	0.0	7	ISLAND PARK	45000.0	45000.0
8 LAKE WALCOTT	39600.0	39500.0	-50.4	0.0	97000.0	0.0	8	AMERICAN FALLS	156830.0	156830.0
9 LAKE MILNER	10900.0	10900.0	0.0	0.0	0.0	0.0	9	AMERICAN FALLS	1399654.0	1002554.7
TOTAL	2938950.0	2949990.0	5565.9	5572.4	2894915.1	0.0	10	ISLAND PARK	90000.0	42268.8
							11	GRASSY LAKE	15204.0	0.0
							12	PALISADES	899502.0	549993.8
							13	HENRYS LAKE	10650.0	10650.0
							14	RIRIE	80000.0	1122.6
							15	AMERICAN FALLS	116106.0	0.0
							16	PALISADES	40898.0	0.0
YEAR-TO-DATE AF	1391078.0	164.8	13896.5	2894915.2	83582.3	-2853.0				

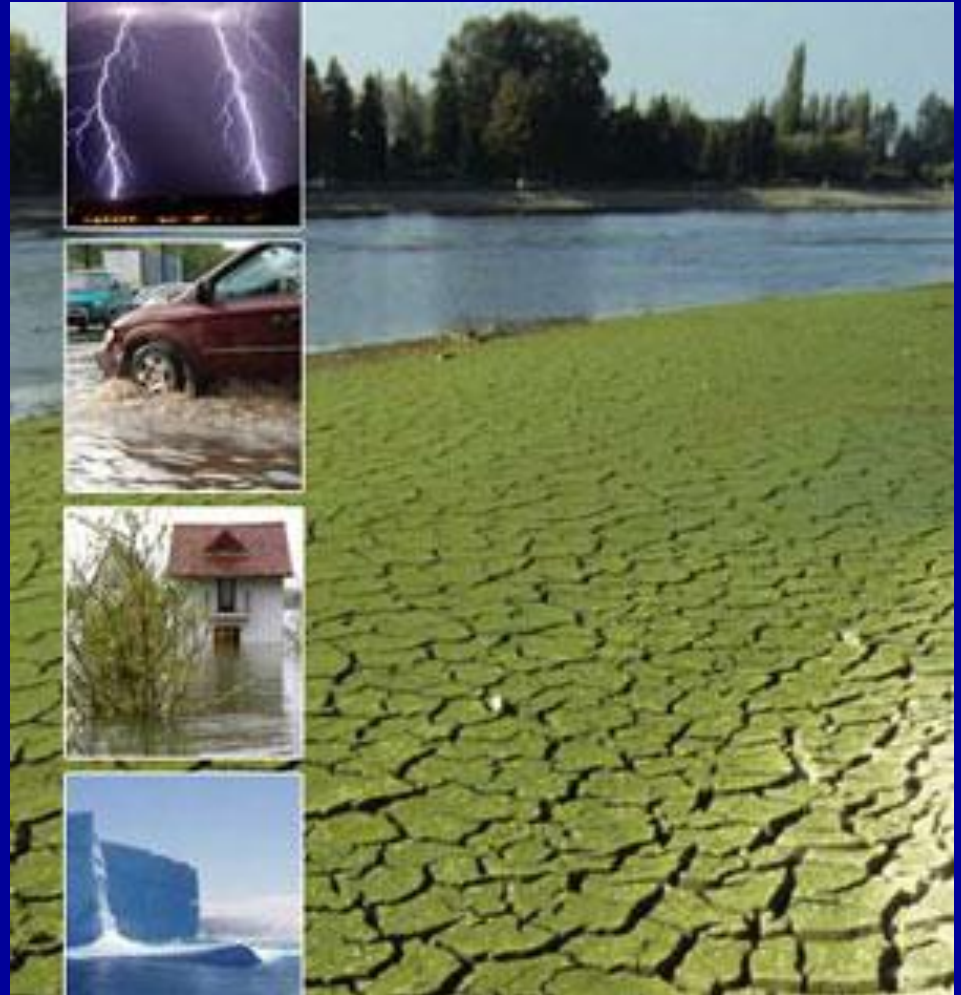
Individual right holder accounting data

DIVERSION DATA - 1, 1997 23-FEB-98

DIVERSION	CFS DIVN	CFS STOR	AF USED	AF RMNG	DIVERSION	CFS DIVN	CFS STOR	AF USED	AF RMNG	DIVERSION	CFS DIVN	CFS STOR	AF USED	AF RMNG	
1 P BIRD	0	0	15	34	112 M REYNOLDS #2	1	1	76	35	223 BUTTE & MARKET L	243	0	0	50579	
2 L CUSHMAN	0	0	0	236	113 C LENZ (R HESS)	0	0	0	0	224 BEAR TRAP	14	0	0	1427	
3 R ROSE	0	0	2	47	114 A NEDROW #1	0	0	0	0	225 WALKER FARMS	0	0	107	-107	
4 PALISADES CANAL	63	0	75	1856	115 A NEDROW #2	0	0	70	-70	226 H TOMCHAK	0	0	0	30	
5 J FLEMING	0	0	0	0	116 J NEDROW	0	0	137	257	227 N FULLMER	1	0	0	0	
6 T LOTT #1	0	0	0	0	117 E & S CLARK	0	0	0	0	228 D BOYCE	0	0	0	0	
7 J WEEKS	0	0	10	64	118 V & D KIRKHAM	0	0	39	105	229 B TOMCHAK #1	0	0	0	98	
8 R JACOBSON	0	0	26	-26	119 D NEDROW	1	1	82	92	230 C BOYCE	0	0	0	394	
9 T LOTT #2	0	0	0	0	120 L FRANSEN (10)	0	0	0	0	231 STIENKE-MURDOCK	0	0	0	473	
10 P PIATAC	0	0	0	0	98	121 L BRATT	0	0	10	0	232 L CARLSON N (13)	0	0	0	0
11 L JACOBSON	0	0	0	246	122 L LOOSLI #1	1	0	4	-4	233 B TOMCHAK #2	0	0	46	397	
12 W BITTON	0	0	0	0	197	123 DEWEY	20	0	4	1824	234 L CARLSON S (13)	0	0	0	0
13 I SPAULDING (TR)	0	0	0	0	148	124 J SEELEY	0	0	71	-71	235 H BROWN	0	0	0	394
14 RILEY	8	0	22	4203	125 YELLOWSTONE	2	0	0	3421	236 KINGSTON NTH	0	0	0	148	
15 B FOSTER	0	0	78	614	126 MARYSVILLE	77	0	0	20280	237 G OFFUT (13)	0	0	0	0	
16 ANDERSON	140	0	383	47516	127 C ATCHLEY (10)	2	0	0	0	238 KINGSTON STH	3	0	0	217	
17 M & M CATTLE (S)	1	1	64	724	128 F & L GRIFFEL	1	1	168	25	239 BEAR ISL NORTH	0	0	0	209	
18 M & M CATTLE (N)	0	0	0	0	129 R BAUM	0	0	27	-27	240 BEAR ISL WEST	0	0	0	86	
19 M NEWBY #1	0	0	0	630	130 H GRIFFEL (10)	0	0	0	0	241 DSGOOD	5	5	146	627	
20 M NEWBY #2 (19)	0	0	0	0	131 FARMERS OWN	38	0	0	7851	242 CLEMENTS	5	5	146	627	
21 M NEWBY #3 (19)	0	0	0	0	132 W SCAFE	0	0	8	40	243 KENNEDY	11	0	0	958	
22 EAGLE ROCK (1)	0	0	0	0	133 R STURN #2 (10)	0	0	0	0	244 GREAT WESTERN	349	0	237	91545	
23 FARMERS FRIEND	70	0	948	10319	134 R STURN #1 (10)	0	0	0	0	245 L HANSEN E	0	0	0	0	
24 ENTERPRISE	76	0	451	39067	135 M GRIFFEL	0	0	59	118	246 A ZOHRER	1	1	110	265	
25 C HICKMAN	0	0	20	-5	136 C LOOSLI #1	3	3	111	62	247 V CENELL	0	0	18	53	
26 BUTLER ISLAND	27	0	39	542	137 CONANT CR CANAL	5	0	0	2025	248 YORGENSON	0	0	15	-15	
27 ROSS AND RAND	0	0	2	57	138 K NYBORG	0	0	0	222	249 R MACKAY (13)	1	0	0	0	
28 STEELE	0	0	129	461	139 BOOM CR CANAL	0	0	0	636	250 IDAHO	808	0	387	93112	
29 HARRISON	35	0	1982	46099	140 SQUIRREL PMP #1	0	0	0	144	251 A BUTIKOFER	0	0	28	-28	
30 CHENEY	1	0	0	393	141 L ORME	0	0	2	94	252 PORTER (17)	150	0	0	0	
31 J BROWN	0	0	0	0	142 SQUIRREL PMP #2	0	0	0	0	253 LOERTSCHER	2	0	0	0	
32 BUTLER ISL #2	0	0	0	591	143 D HARSHBARGER	1	1	112	81	254 BOYD FOSTER	0	0	40	-40	
33 G SCOTT (11)	0	0	0	0	144 SQUIRREL PMP #3	0	0	0	135	255 B JOHNSON	0	0	0	0	
34 RUDY	134	46	2127	25612	145 D ZUNDELL	0	0	0	329	256 LOVELL # 1	0	0	0	0	
35 LOWDER SLOUGH	52	10	751	2035	146 L LOOSLI #2	3	0	0	0	257 FERGUSON	1	0	0	0	
36 KITE & NORD	0	0	55	244	147 C & L LOOSLI	1	1	67	51	258 LOVELL # 2	0	0	0	0	
37 BURGESS	886	85	1924	48881	148 C LOOSLI #2	0	0	58	-58	259 WALLACE REID	0	0	0	0	
38 M H HILL	0	0	33	-19	149 J HILL	0	0	0	0	19	260 SARGENT & SUMMRS	0	0	0	0
39 CLARK & EDWARDS	70	0	127	705	150 D REYNOLDS	0	0	93	273	261 DURTSCHI PUMPS	0	0	0	0	
40 CROFT	0	0	66	210	151 C LOOSLI #3	0	0	164	26	262 REED PUMPS	0	0	0	0	
41 A ZAUGG	0	0	26	4	152 T POTTER	0	0	0	58	263 FOSTER-SARGENT P	0	0	0	345	
42 G HOLMAN	0	0	23	16	153 ENTERPRISE	98	98	1256	24440	264 SPERRY	0	0	0	0	
43 L TYLER	0	0	5	68	154 ATCHLEY #2 (10)	0	0	0	0	265 ORVAL AVERY	0	0	0	0	
44 EAST LABELLE	98	0	192	595	155 R D MILLER	0	0	0	183	266 ROY AVERY	14	0	0	0	
45 B GROVER	0	0	17	-17	156 ATCHLEY #1 (10)	0	0	0	0	267 STUCKI PUMPS	0	0	0	0	
46 RIGBY LATERL (3)	0	0	0	0	157 W C DAVIS (10)	0	0	0	0	268 ORVAL AVERY PUMP	0	0	0	0	
47 RIGBY	116	0	376	6256	158 FALL RIVER CANAL	164	0	225	7035	269 ROY COOPER SAND	0	0	0	0	
48 K FOSTER	1	1	94	-94	159 CHESTER	60	0	0	1595	270 ROY COOPER WILL	6	0	0	0	
49 WHITE ISLAND	1	1	192	-192	160 MCBEE	0	0	1	-1	271 PROGRESSIVE SAND	372	0	0	0	
50 DILTS LATERAL (2)	0	0	0	0	161 SILKEY	11	0	0	419	272 BEAN	4	0	0	0	
51 DILTS	24	0	348	2210	162 CURR	30	0	29	15	273 W & O COOPER	0	0	0	0	
52 ISLAND	129	0	0	4626	163 G BLANCHARD	0	0	0	5	274 IDAHO FR SAND CK	28	28	407	-407	
53 W LABELLE & LG	330	0	0	6521	164 D BLANCHARD	0	0	0	0	275 PROGRESSIVE WILL	75	11	456	-456	
54 PARKS & LEWSLVE	268	0	179	5234	165 LAST CHANCE	48	0	0	14268	276 DEMICK	0	0	0	0	
55 NORTH RIGBY	44	0	216	1034	166 CROSSCUT TO TETN	79	42	3872	-3872	277 IF MONROC LARGE	0	0	24	-24	
56 JEFF HILLS EL C	0	0	0	84	167 XCUT FALL R (16)	117	0	0	0	278 IF MONROC LYONS	0	0	0	0	
57 JEFF HILLS EMB	0	0	0	10	168 FARMERS FRIEND	57	0	0	5539	279 MOODVILLE	38	0	0	0	
58 WHITE DITCH (3A)	0	0	0	0	169 TWIN GROVES	95	0	0	5502	280 SNAKE RIVER VY	429	0	0	90741	
59 J W JONES #	0	0	0	49	170 ST ANTHONY UNION	282	0	42	9495	281 P HILL (14)	0	0	0	0	

Next?

- Build Model based on historical reactions to drought/Flood
- Climate Change Scenarios



Questions?

