

NEVADA DIVISION OF
WATER RESOURCES



Nevada Department of
**CONSERVATION &
NATURAL RESOURCES**

Offsets in Conjunctive Management: What are they and how do they work?

Humboldt River Stakeholder Working Group

January 8, 2025, Battle Mountain, Nevada

NDWR

OFFSET - DEFINITION

A quantity of water or other form of credit that can be used to 'mitigate' the portion of a groundwater right that conflicts with senior surface water rights.

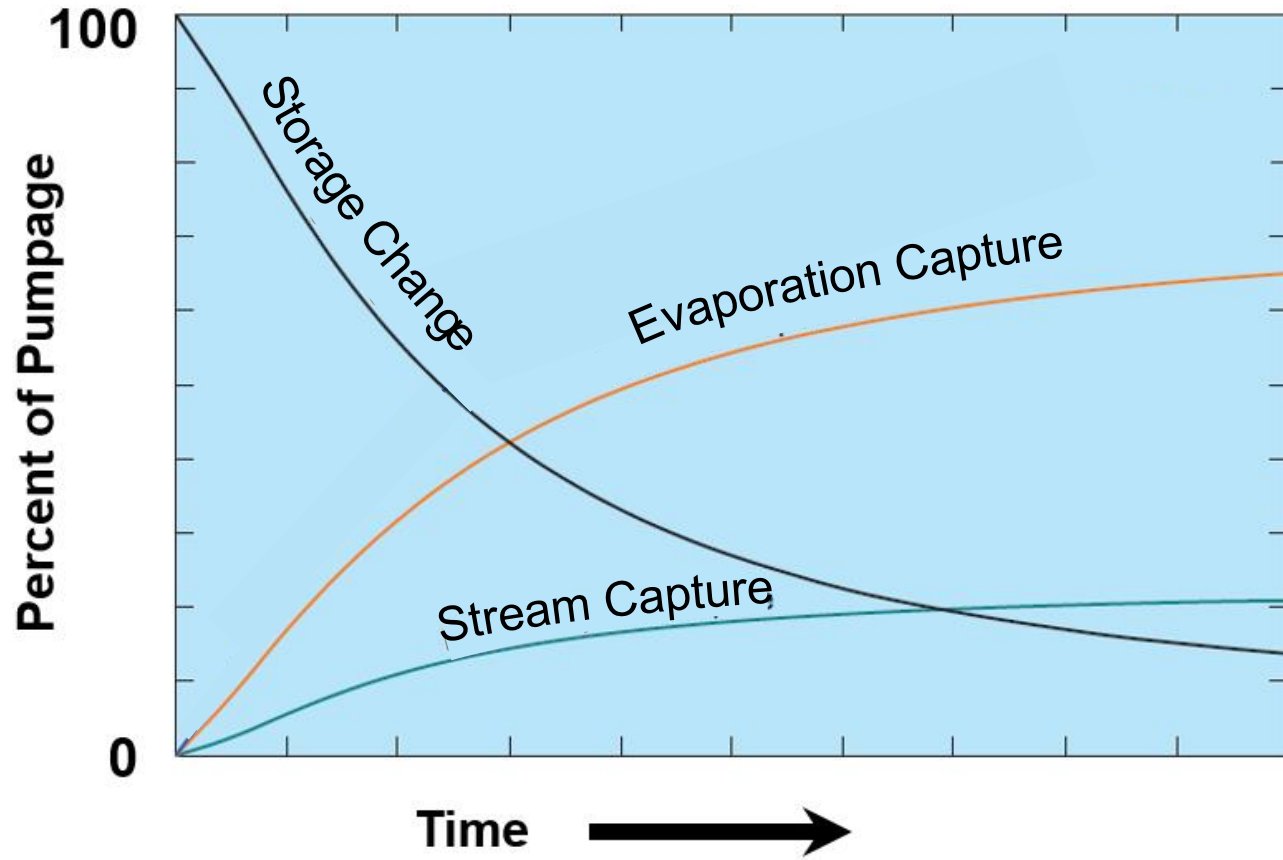
OFFSET TYPES FOR TODAY'S DISCUSSION

Augmentation of streamflow

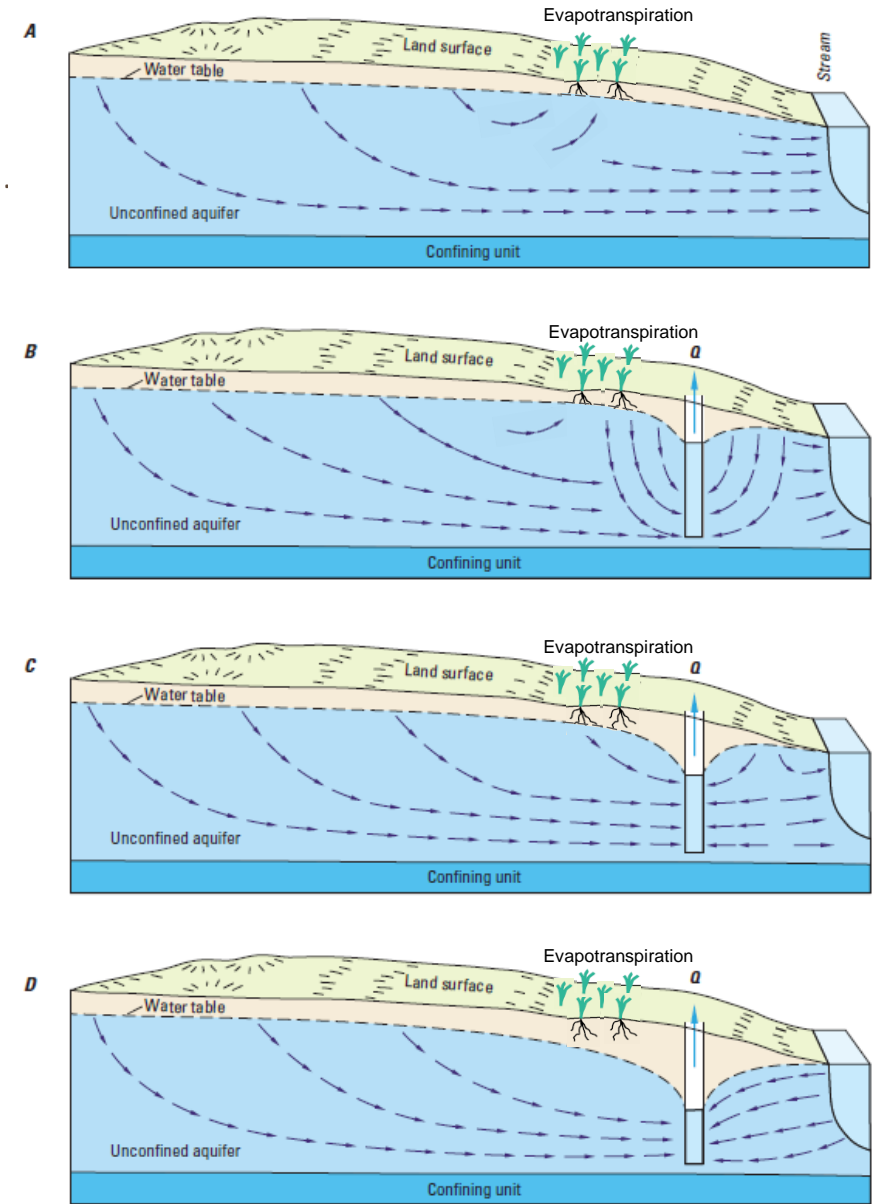
In-stream replacement using Humboldt Decree water

Managed Aquifer Recharge (MAR)

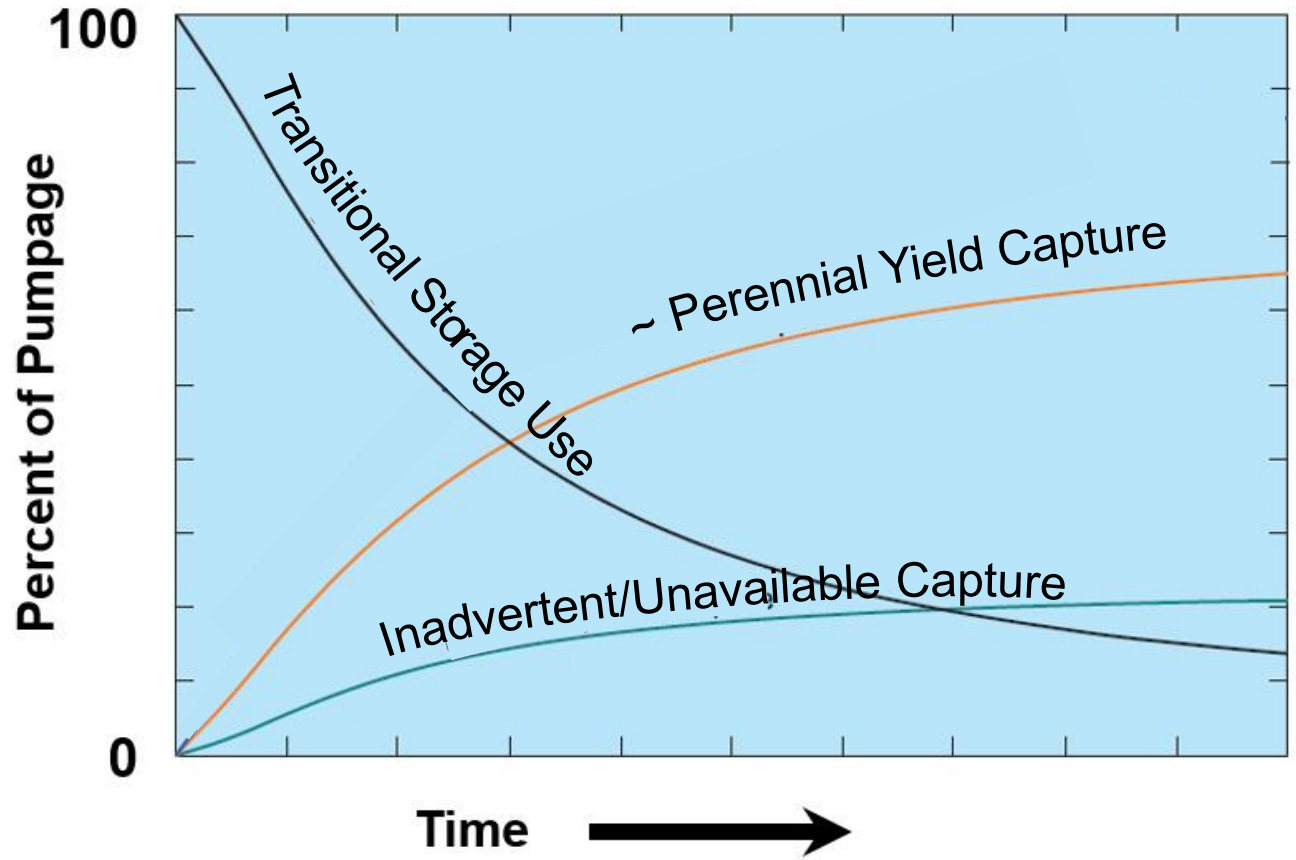
WHAT IS STREAM CAPTURE?



Stream Capture = Streamflow Depletion



WATER MANAGEMENT PERSPECTIVE

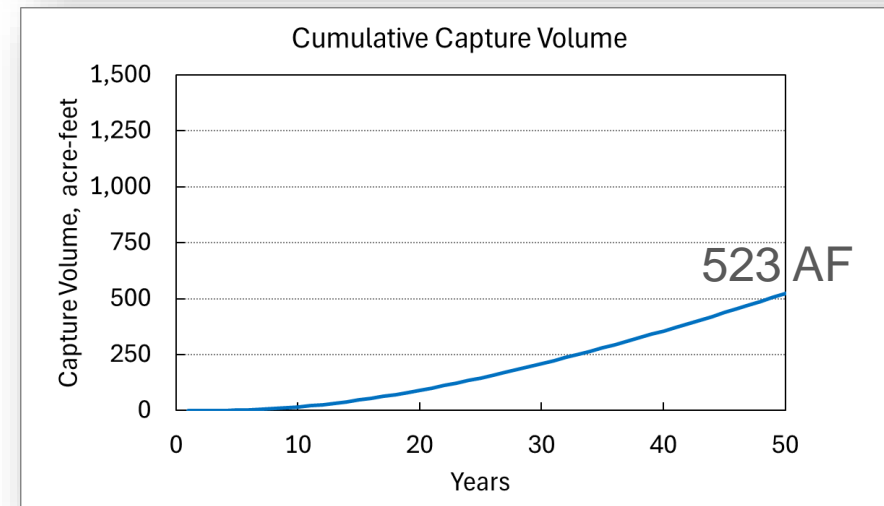
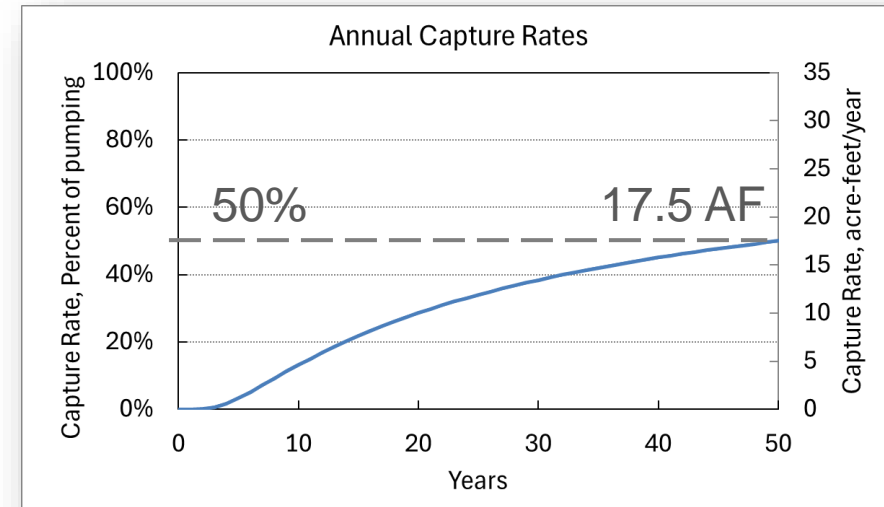
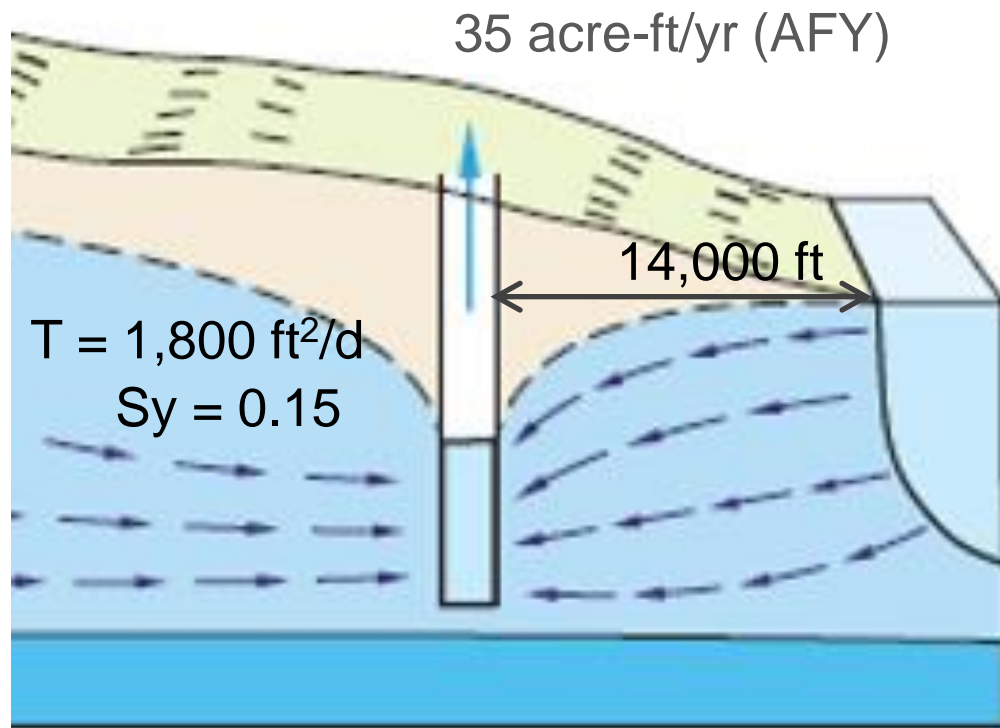


Capture curves conceptualized through water management perspective.

Conflict when coming from fully appropriated SW source.

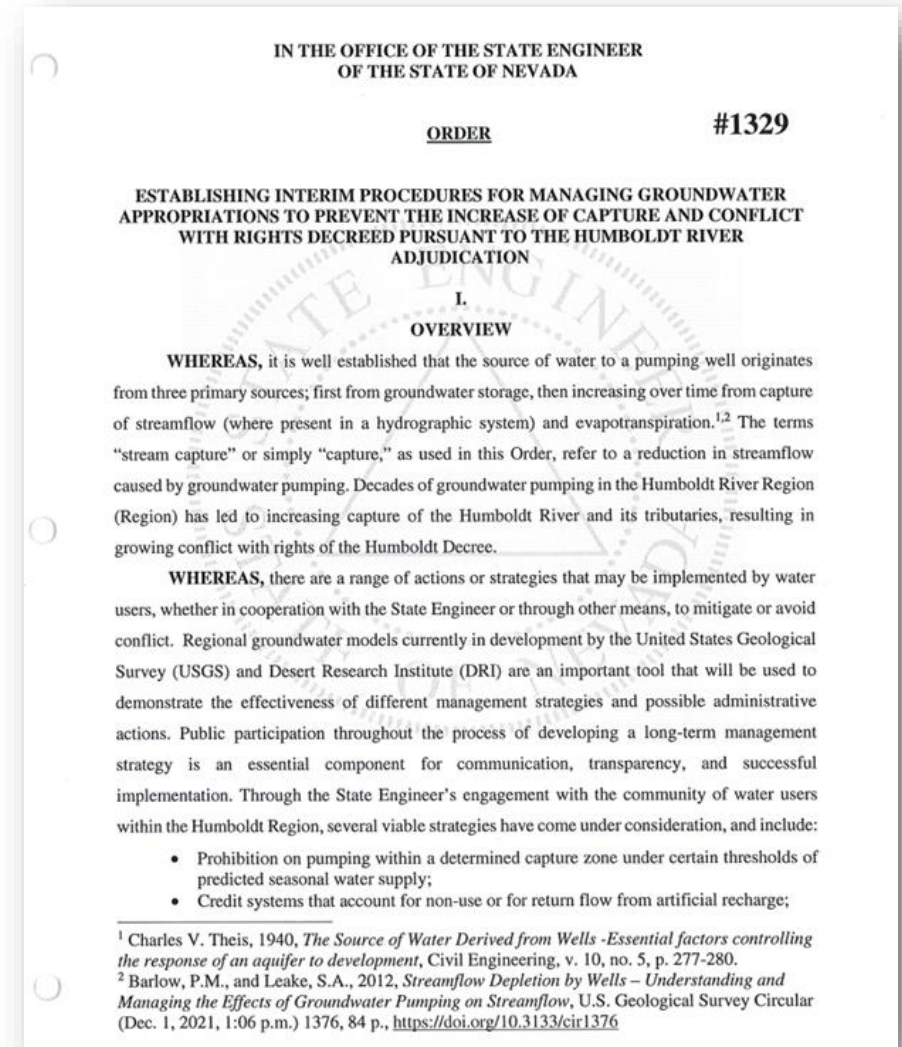
HYPOTHETICAL CAPTURE USED IN THIS DEMONSTRATION

Hypothetical well that pumps for 50 years



CAPTURE CONFLICT CRITERIA – CAPTURE EVALUATED OVER 50-YEAR PERIOD

- Exemption status:
 - <5 AFY after 50 yrs of pumping – exempt.
 - <10% capture after 50 yrs of pumping – exempt.
 - otherwise, Offset is required.
- Successful Offset Criteria:
 - equal or exceed cumulative volume of capture within 50 years.
 - equal or exceed annual capture in 40 out of 50 years (80 percent rule).

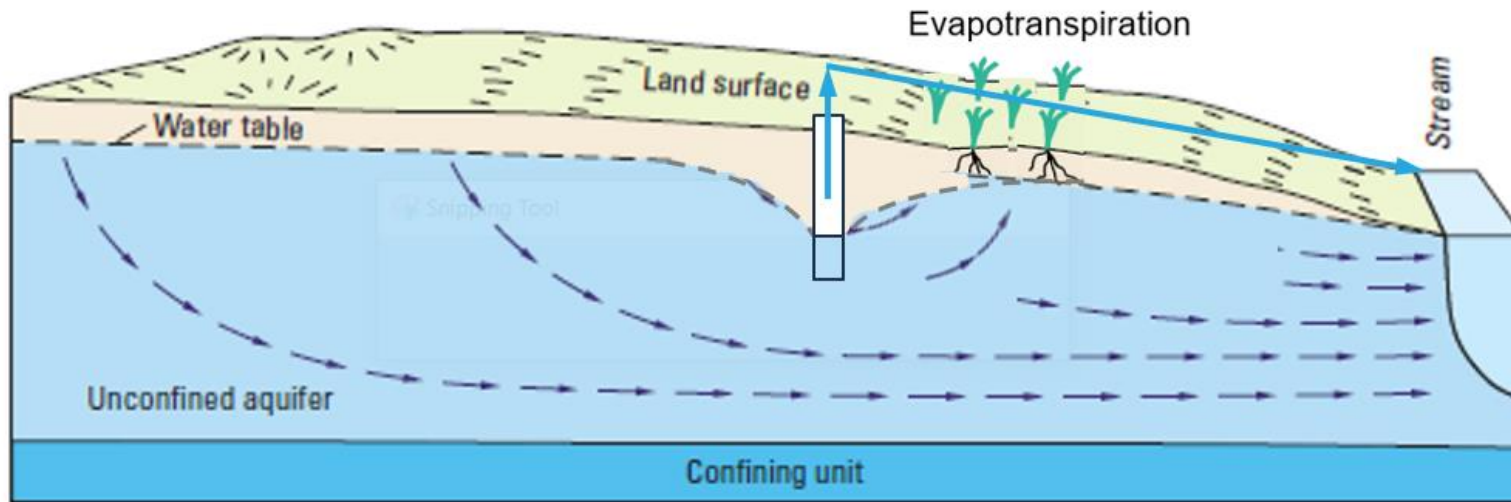


AUGMENTATION OF STREAMFLOW

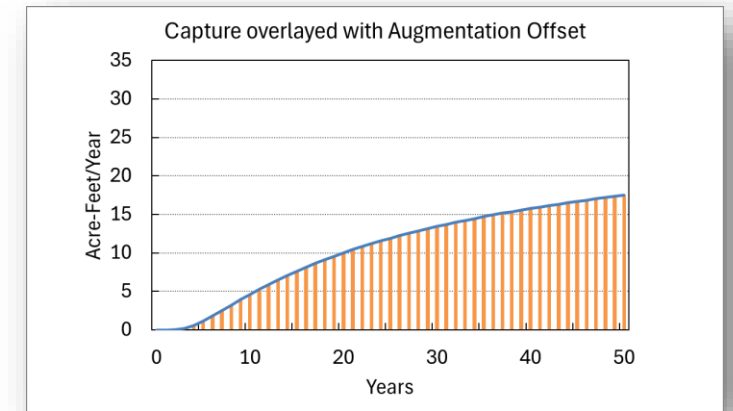
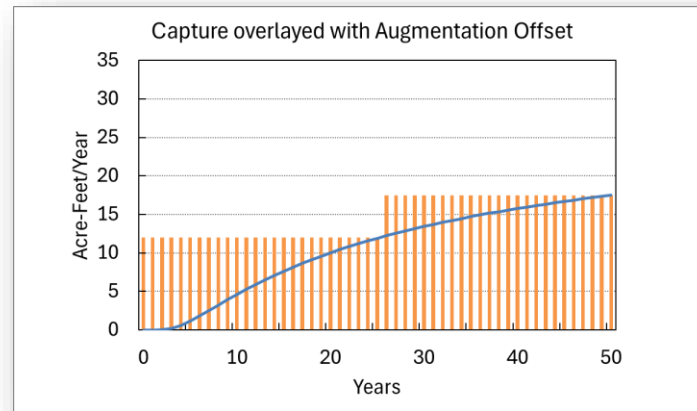
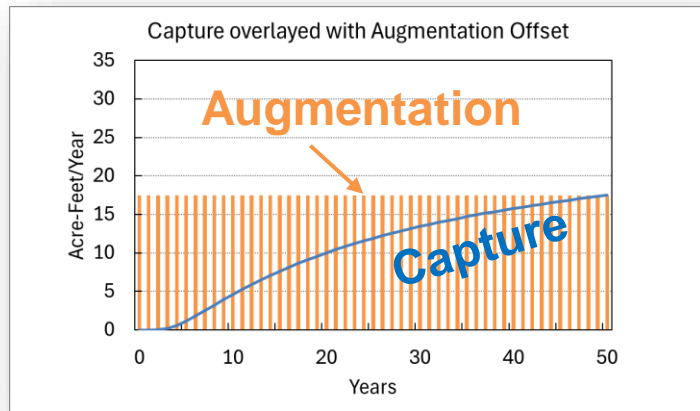
AUGMENTATION OF STREAMFLOW

Increasing streamflow through direct addition of water

- Direct discharge to stream or tributary.
- Source:
 - Groundwater with low to no stream capture.
 - Reservoirs.
 - Imported from other surface water/streams.
 - Wastewater discharge.

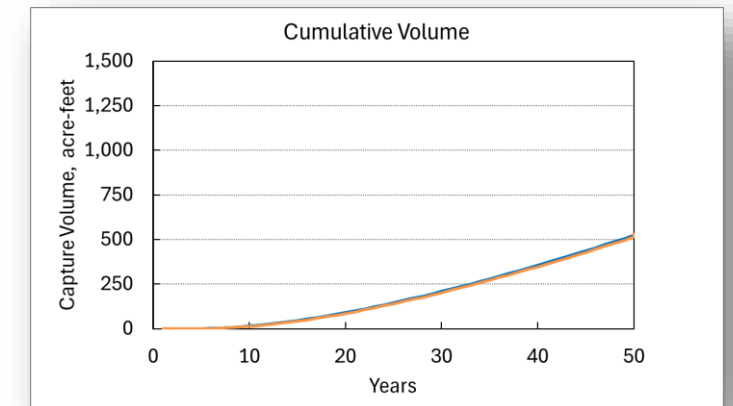
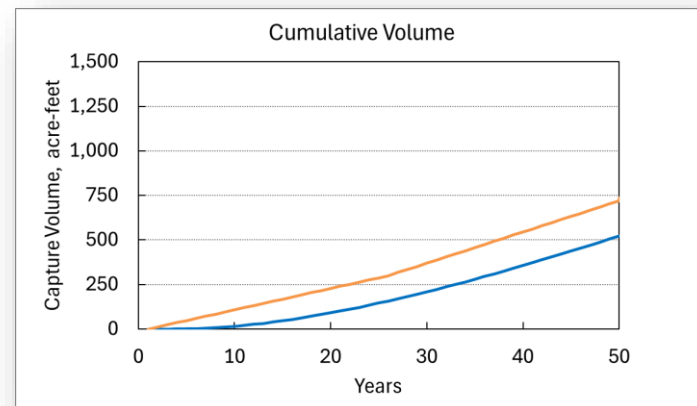
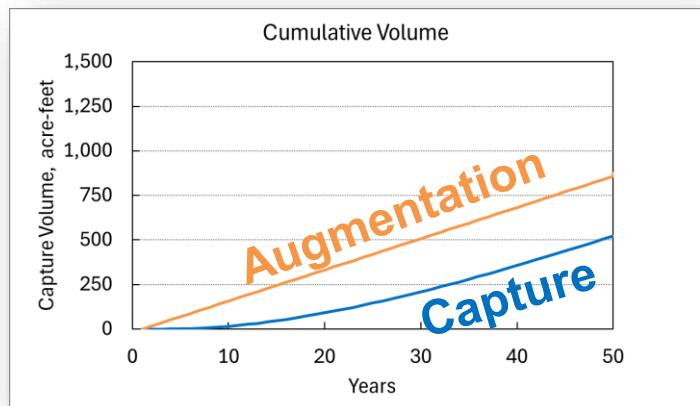


WHAT AUGMENTATION OFFSETS COULD LOOK LIKE



Or

Or

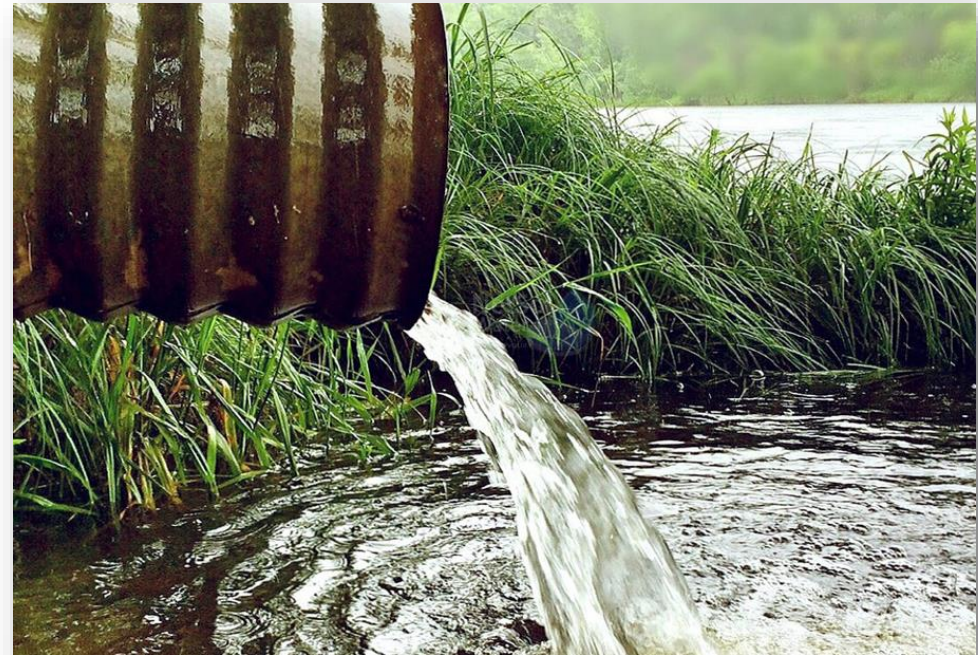


AUGMENTATION – EXAMPLES OF EXISTING AUGMENTATIONS

Mine Discharge



Treated Wastewater Effluent



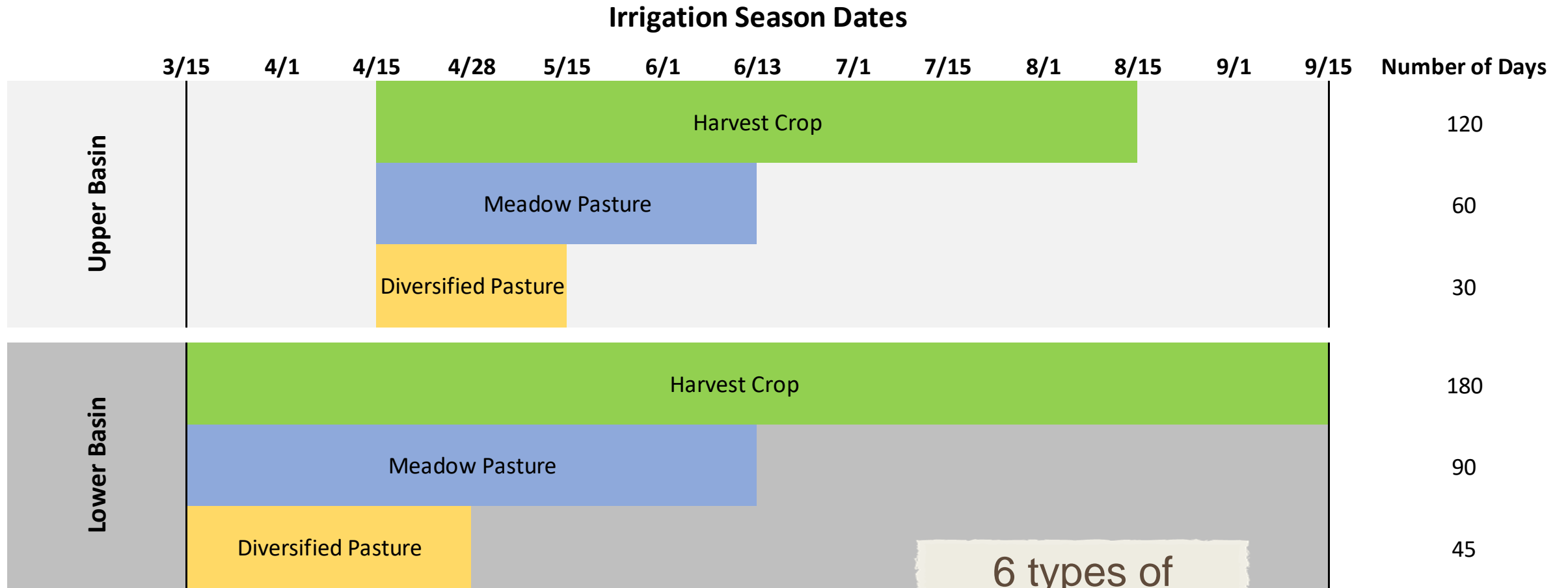
IN-STREAM OFFSET USING HUMBOLDT DECREE WATER

IN-STREAM OFFSET USING HUMBOLDT DECREE WATER

Primary Considerations:
Priority, Duty, Location,
Culture Class

- Complex conversion calculation.
- Subject to year-to-year water availability (wetness factor).
- Can move from downstream to upstream relatively easily.
- Very difficult to move from upstream to downstream due to inherent losses in the system.
- Can use tributary stream decree to offset main stem impacts.
- Cannot use mainstream decree to offset tributary impacts.
- Available in the Humboldt.

DECREE WATER OFFSET – WETNESS FACTOR COMPUTATION – DIFFERENT SEASONS FOR UPPER VS LOWER BASIN AND CULTURE CLASS



6 types of
Decree Offsets

DECREE WATER OFFSET – WETNESS FACTOR COMPUTATION – PRIORITY IS DETERMINED BASED ON PALISADE FLOW

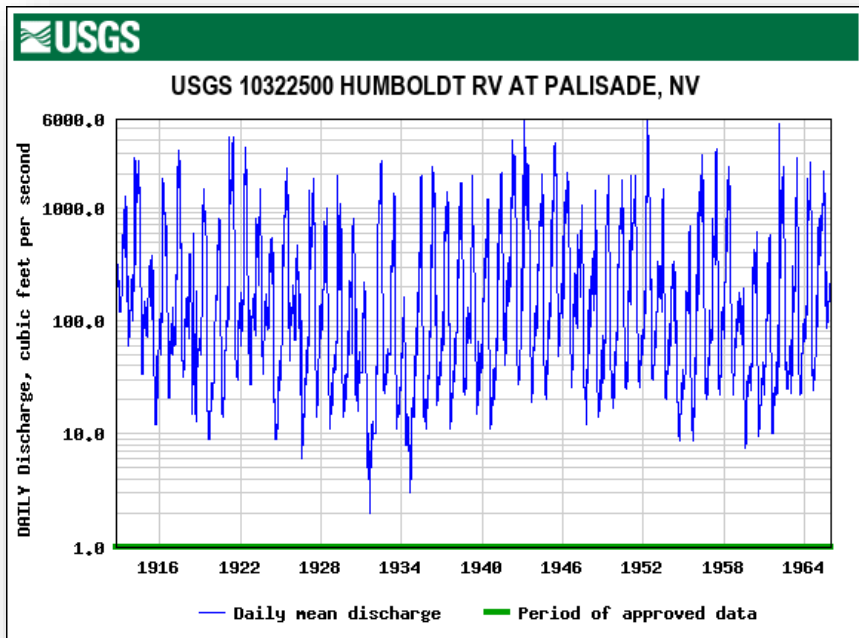
HUMBOLDT RIVER PRIORITY
CHART AT PALISADE

Priority	Palisade		Rye Patch		6/13 - 9/15	
	3/15 - 4/28	4/28 - 6/13	4/28 - 6/13	6/13 - 9/15	6/13 - 9/15	6/13 - 9/15
1861	7.951 - 6.361	2.840 - 2.272	2.154 - 1.723			
1862	7.071 - 7.257	3.960 - 3.168	3.221 - 2.619			
1863	23.129 - 10.676	10.295 - 4.232	7.681 - 3.683			
1864	56.679 - 20.747	29.119 - 11.126	17.341 - 3.968			
1865	60.733 - 20.747	31.501 - 11.126	19.008 - 3.968			
1866	68.325 - 26.821	35.211 - 14.030	22.638 - 6.872			
1867	77.664 - 34.292	43.305 - 20.505	27.269 - 10.577			
1868	80.433 - 35.440	45.251 - 21.653	28.308 - 11.226			
1869	82.946 - 35.440	47.411 - 21.653	30.415 - 11.226			
1870	91.188 - 35.440	54.354 - 21.653	35.784 - 11.226			
1871	148.116 - 50.008	95.058 - 29.948	68.531 - 17.062			
1872	156.793 - 50.839	102.879 - 30.779	75.334 - 17.078			
1873	257.246 - 102.180	167.818 - 65.074	134.100 - 49.124			
1874	353.259 - 124.074	235.221 - 83.353	173.805 - 63.927			
1875	365.413 - 125.554	245.044 - 84.770	177.759 - 65.344			
1876	415.715 - 157.665	286.178 - 112.628	210.686 - 87.838			
1877	500.940 - 215.013	319.905 - 131.927	230.969 - 98.209			
1878	545.165 - 240.685	340.270 - 144.757	249.184 - 109.893			
1879	590.779 - 241.935	374.808 - 146.007	267.876 - 110.328			
1880	666.304 - 272.389	412.449 - 160.657	294.566 - 121.185			
1881	675.331 - 277.492	417.946 - 164.149	299.500 - 124.377			
1882	679.268 - 278.461	419.929 - 164.874	300.862 - 125.102			
1883	724.471 - 299.637	448.949 - 177.530	327.976 - 137.374			
1884	729.158 - 303.061	453.499 - 180.891	332.110 - 140.681			
1885	739.206 - 309.977	464.444 - 188.948	342.378 - 148.738			
1886	768.491 - 315.035	478.838 - 192.169	349.826 - 151.959			
1887	910.371 - 372.680	547.144 - 208.837	391.295 - 167.533			
1888	1003.075 - 421.974	621.443 - 254.625	455.934 - 213.222			
1889	1004.639 - 422.899	623.006 - 255.550	457.498 - 214.847			
1890	1040.971 - 442.427	645.296 - 269.773	475.168 - 227.337			

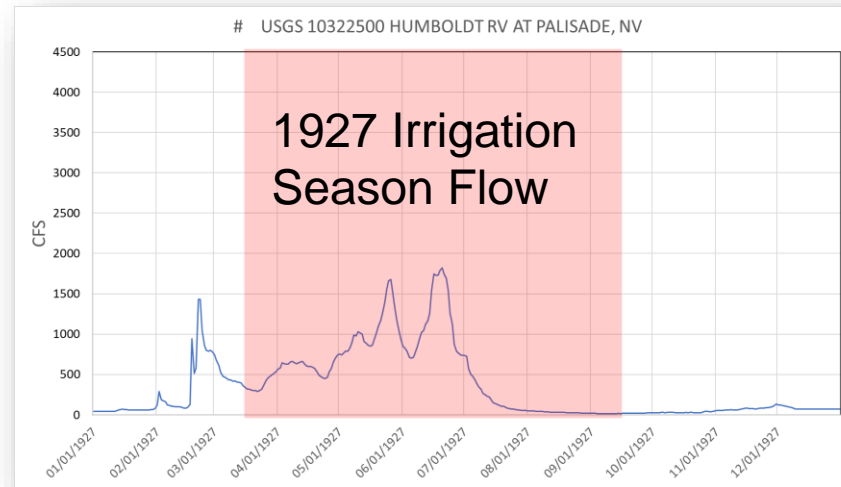
1890	1040.971 - 442.427	645.296 - 269.773	475.168 - 227.337
1891	1055.163 - 451.280	656.118 - 277.249	483.594 - 234.078
1892	1058.198 - 453.708	657.486 - 278.344	484.963 - 235.173
1893	1080.443 - 471.504	670.229 - 288.538	486.780 - 236.627
1894	1083.893 - 474.264	673.679 - 291.298	488.363 - 237.843
1895	1084.655 - 474.874	674.441 - 291.908	489.125 - 238.503
1896	1084.903 - 475.072	674.689 - 292.106	489.373 - 238.701
1897	1106.708 - 475.852	679.210 - 292.838	493.894 - 239.433
1898	1115.814 - 477.579	681.776 - 294.565	496.055 - 241.160
1899	1117.650 - 479.048	683.613 - 296.034	497.889 - 242.629
1900	1160.320 - 513.184	724.573 - 328.802	538.849 - 275.397
1901	1163.516 - 515.661	726.528 - 330.293	540.754 - 276.873
1902	1170.090 - 516.419	730.794 - 331.051	541.701 - 277.631
1903	1171.430 - 517.491	732.134 - 332.123	543.041 - 278.703
1904	1186.650 - 518.293	740.683 - 332.890	544.305 - 279.470
1905	1186.751 - 518.374	740.784 - 332.971	544.406 - 279.551
1906	1190.080 - 521.037	744.113 - 335.634	547.735 - 282.214
1907	1190.233 - 521.159	744.265 - 335.756	547.888 - 282.336
1908	1191.724 - 522.352	745.756 - 336.949	549.379 - 283.529
1909	1194.434 - 524.519	748.129 - 338.847	551.751 - 285.427
1910	1196.804 - 526.416	750.500 - 340.744	554.123 - 287.324
1911	1197.565 - 527.025	751.206 - 341.309	554.829 - 287.889
1912	1216.288 - 530.300	761.984 - 344.584	565.546 - 291.164
1913	1220.275 - 533.490	765.971 - 347.774	569.534 - 294.354
1914	1230.073 - 536.559	772.494 - 350.232	576.021 - 296.812
1915	1231.365 - 537.593	773.786 - 351.266	577.314 - 297.846
1916	1234.256 - 539.906	776.677 - 353.579	580.205 - 300.159
1917	1236.999 - 542.100	779.420 - 355.773	582.948 - 302.353
1918	1241.748 - 545.184	784.169 - 358.857	587.696 - 305.437
1919	1242.991 - 546.179	785.413 - 359.852	588.940 - 306.432
1920	1244.851 - 547.667	787.273 - 361.340	590.800 - 307.920
1921	1244.900 - 547.706	787.321 - 361.379	590.849 - 307.959

DECREE WATER OFFSET- WETNESS FACTOR COMPUTATION – PRIORITY SERVED BASED ON HISTORIC IRRIGATION SEASON FLOW RECORD

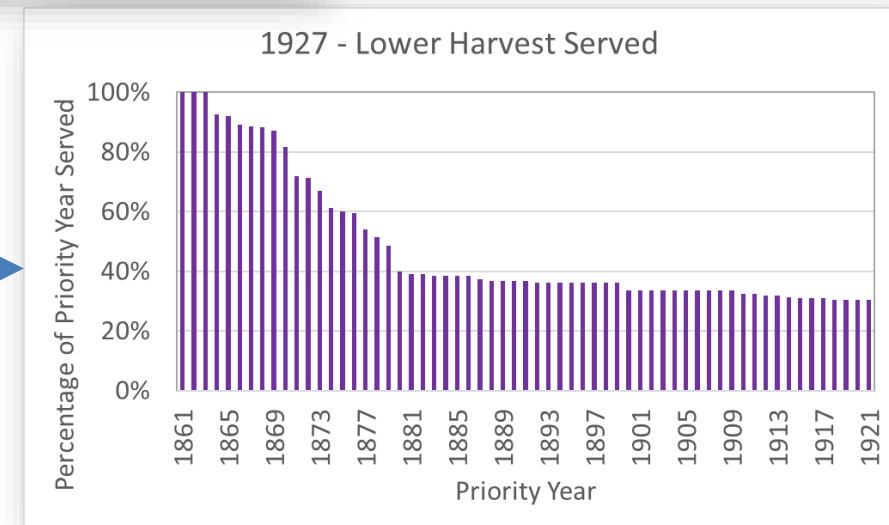
How much of each priority was historically served?



Period used:
1912 - 1965



1927 example:
a normal year

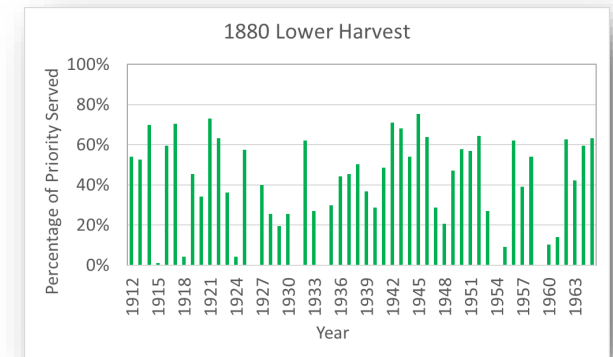
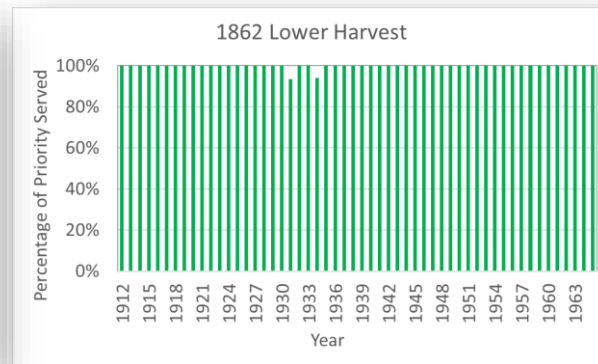
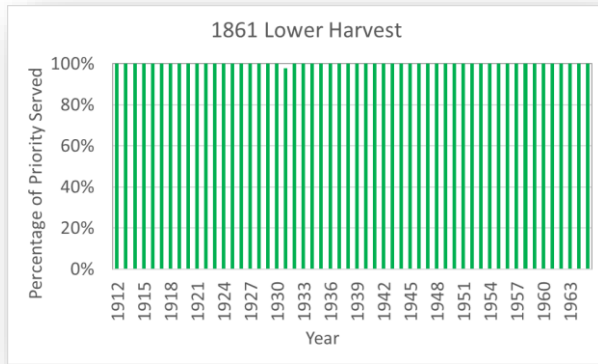


DECREE WATER OFFSET – WETNESS FACTOR COMPUTATION – PRIORITY SERVED BASED ON HISTORIC IRRIGATION SEASON FLOW RECORD

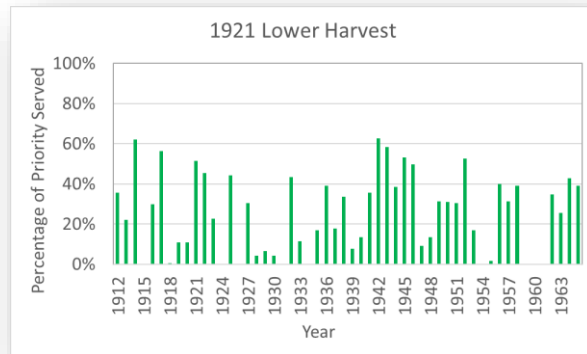
Most Senior



Junior



Most Junior

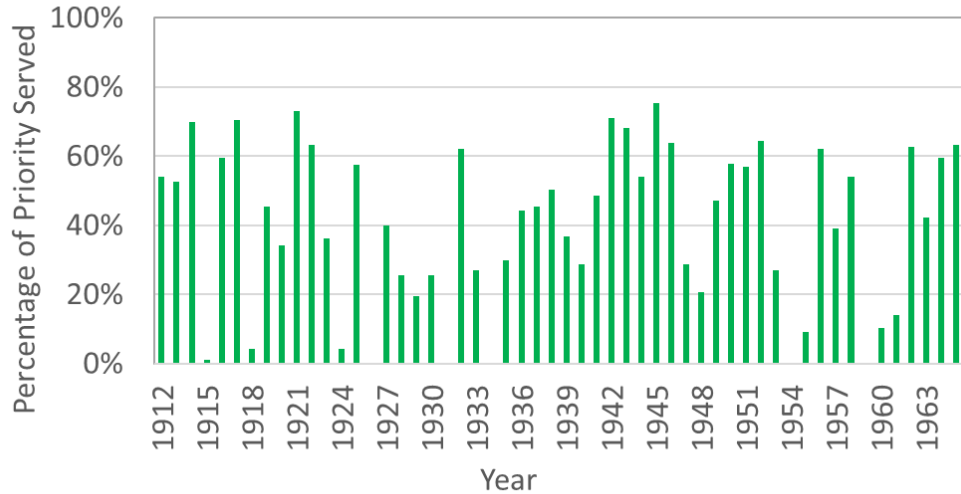


Senior decree was served more than junior decree



DECREE WATER OFFSET – WETNESS FACTOR COMPUTATION – CONVERSION OF DECREE RIGHT TO ANNUAL DUTY SERVED

1880 Lower Harvest



Duty of this 1880 Lower Harvest Decree Right = 66.1 AF

110

THE BARTLETT DECREE

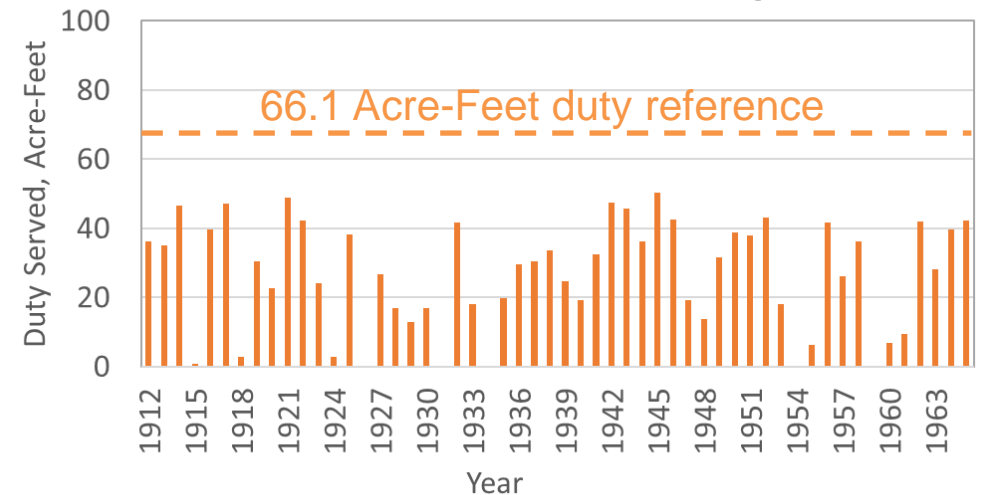
Ellison Ranching Co.—Continued.

Priority	CULTURE ACRES			LOCATION				Length of Season	DUTY OF WATER	
	Harvest	Meadow Pasture	Diversified Pasture	Subdivision	Sec.	Tp.	R.		C. F. S.	Acre Feet
1880	.....	3.25	.....	NE $\frac{1}{4}$ NE $\frac{1}{4}$	1	38	46	3-15- 6-13	.026	4.88
1880	.....	15.06	.....	NW $\frac{1}{4}$ NE $\frac{1}{4}$	1	38	46	3-15- 6-13	.122	2.26
1880	.....	2.74	.....	NE $\frac{1}{4}$ NW $\frac{1}{4}$	1	38	46	3-15- 6-13	.022	.41
1880	22.03	.....	.....	NE $\frac{1}{4}$ NE $\frac{1}{4}$	12	38	46	3-15- 9-15	.179	66.09
1880	.....	.....	9.65	NE $\frac{1}{4}$ NE $\frac{1}{4}$	12	38	46	3-15- 4-28	.078	7.24
1880	28.80	.....	.....	NW $\frac{1}{4}$ NE $\frac{1}{4}$	12	38	46	3-15- 9-15	.234	86.40



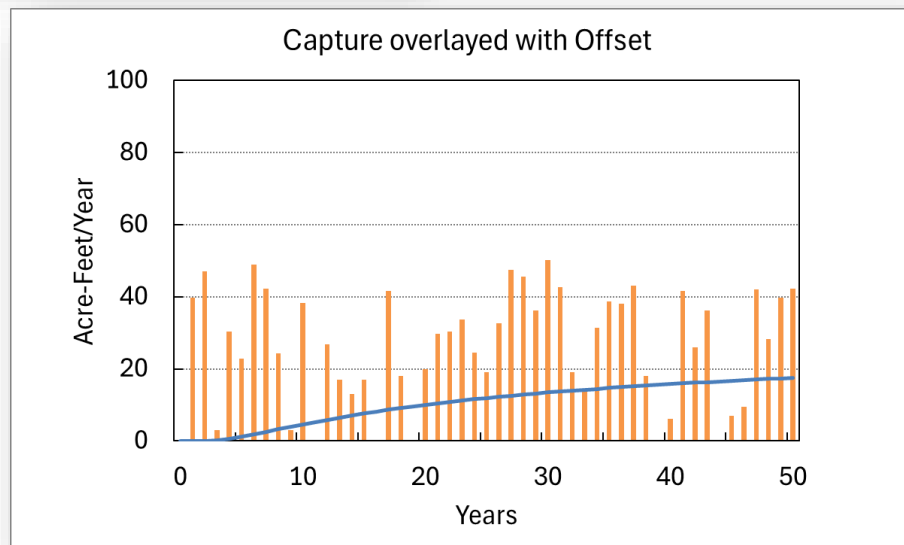
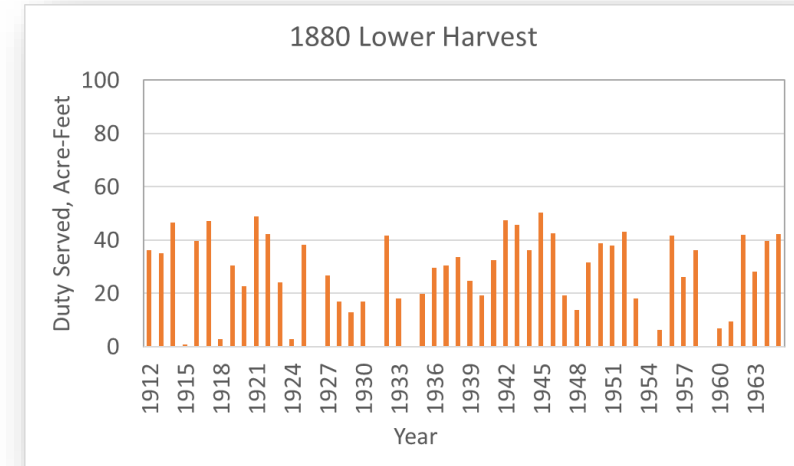
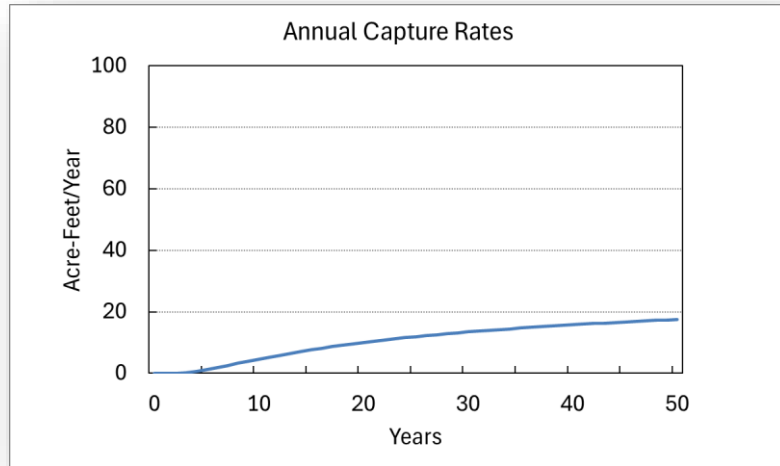
1880 Lower Harvest

Offset



For most priority dates, actual duty served is less than duty of water right.

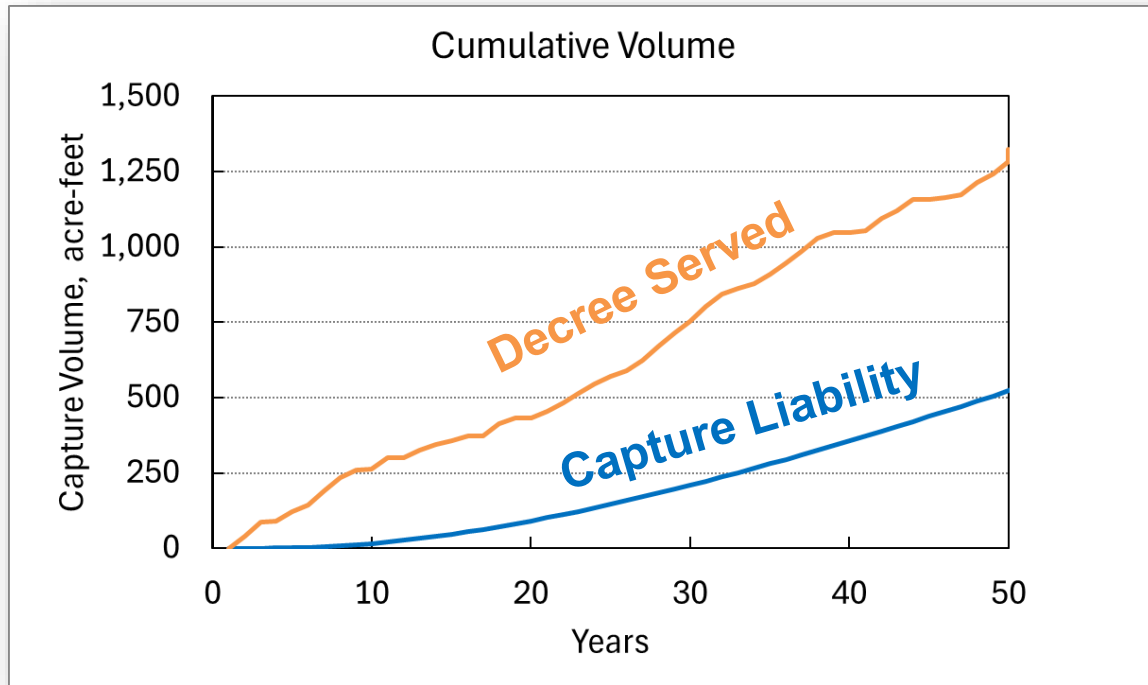
DECREE WATER OFFSET – WETNESS FACTOR COMPUTATION – DETERMINED AGAINST CAPTURE LIABILITY CURVE



Offset is compared with capture curve and criteria evaluated.

DECREE WATER OFFSET – WETNESS FACTOR COMPUTATION – CRITERIA EVALUATION

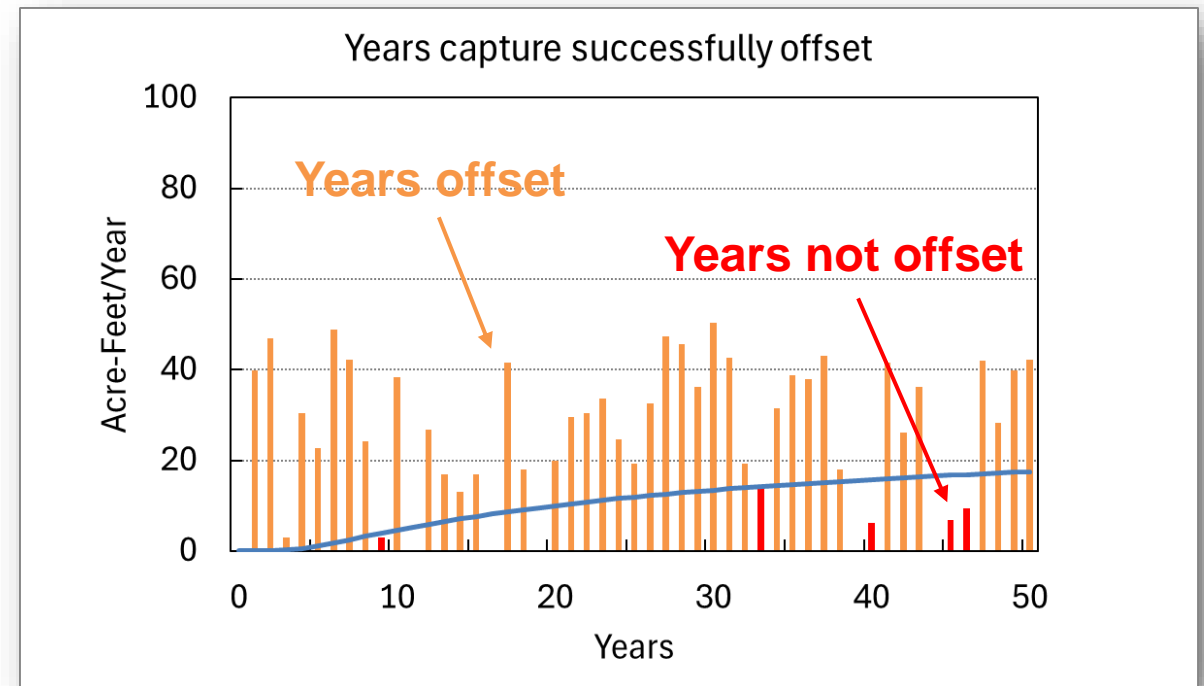
Cumulative Volume Criteria



Cumulative Offset volume >
Capture Liability



Percentage of years capture successfully offset criteria (80 percent rule)

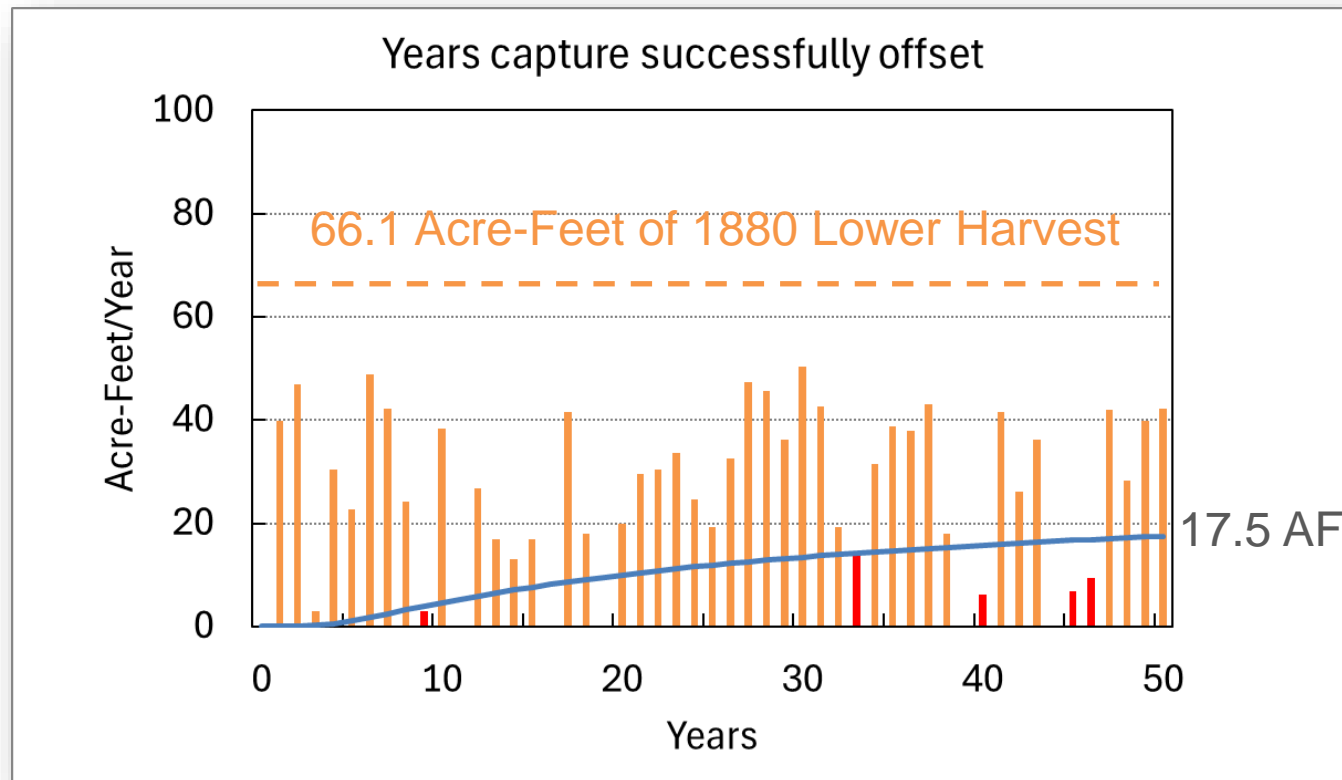


40 of 50 years successfully offset.



DECREE WATER OFFSET – WETNESS FACTOR COMPUTATION

$$Wetness\ Factor_{Priority,Basin,Culture} = \frac{50\ yr\ capture\ liability}{Duty\ of\ offset}$$

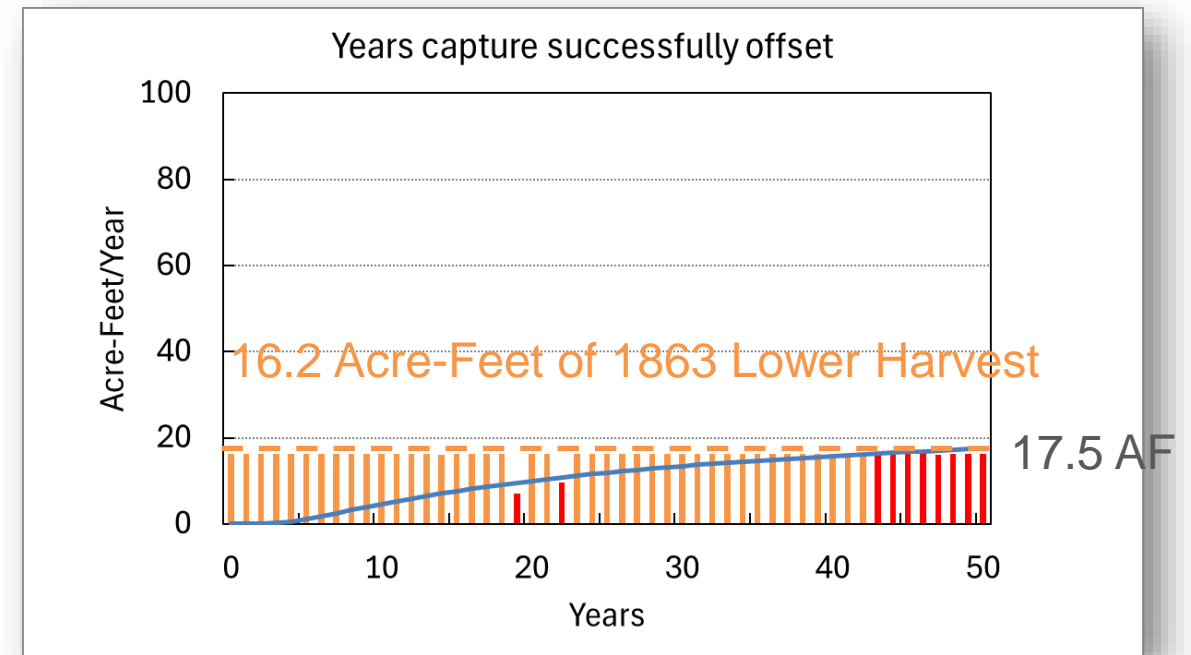
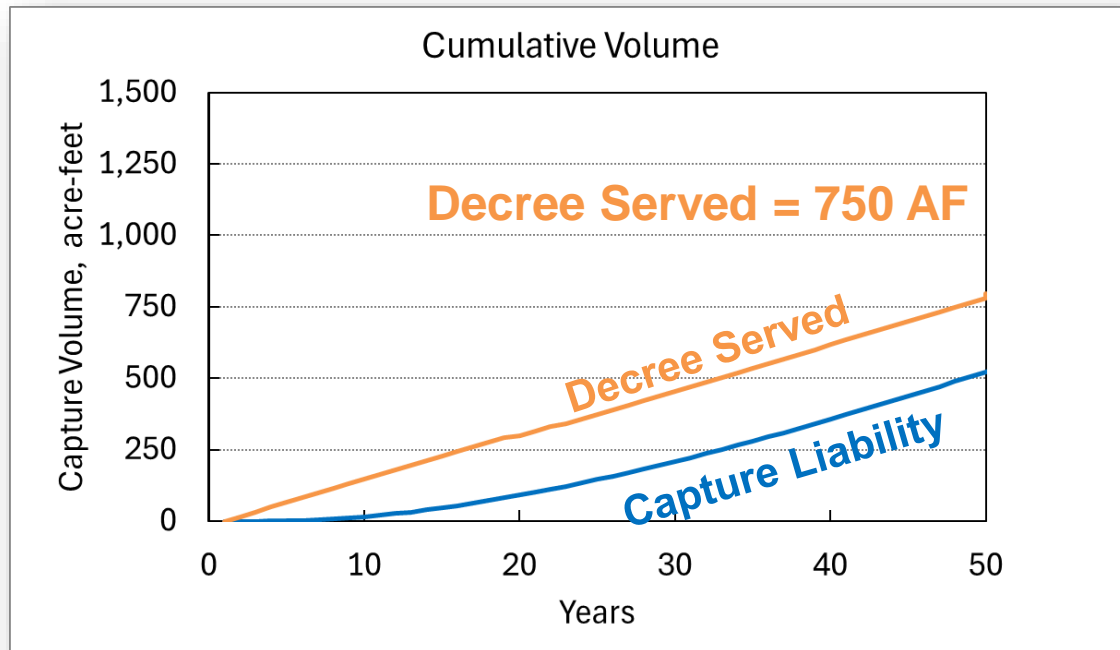


$$WF_{1880LH} = \frac{17.5\ AF}{66.1\ AF} = 26.5\%$$

DECREE WATER OFFSET – WETNESS FACTOR FOR A VERY SENIOR DECREE

For an 1863 Lower Harvest. A duty of only 16.2 AF is needed:

$$WF_{1863LH} = \frac{17.5 \text{ AF}}{16.2 \text{ AF}} = 108\%$$



Cumulative Offset volume > Capture Liability



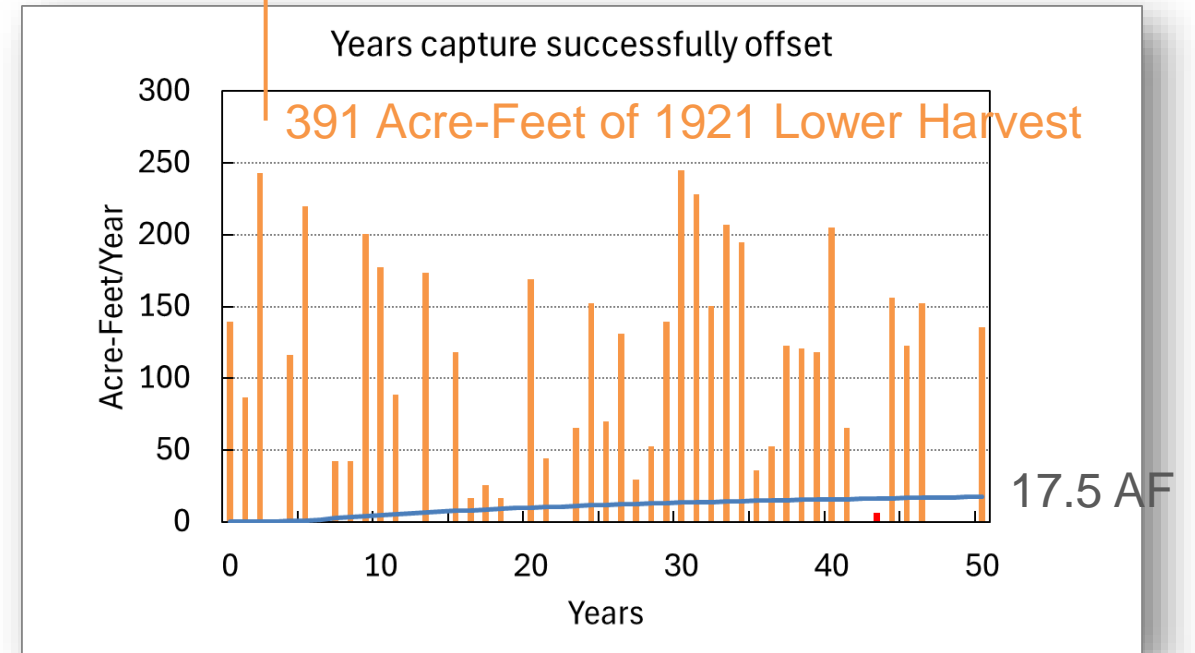
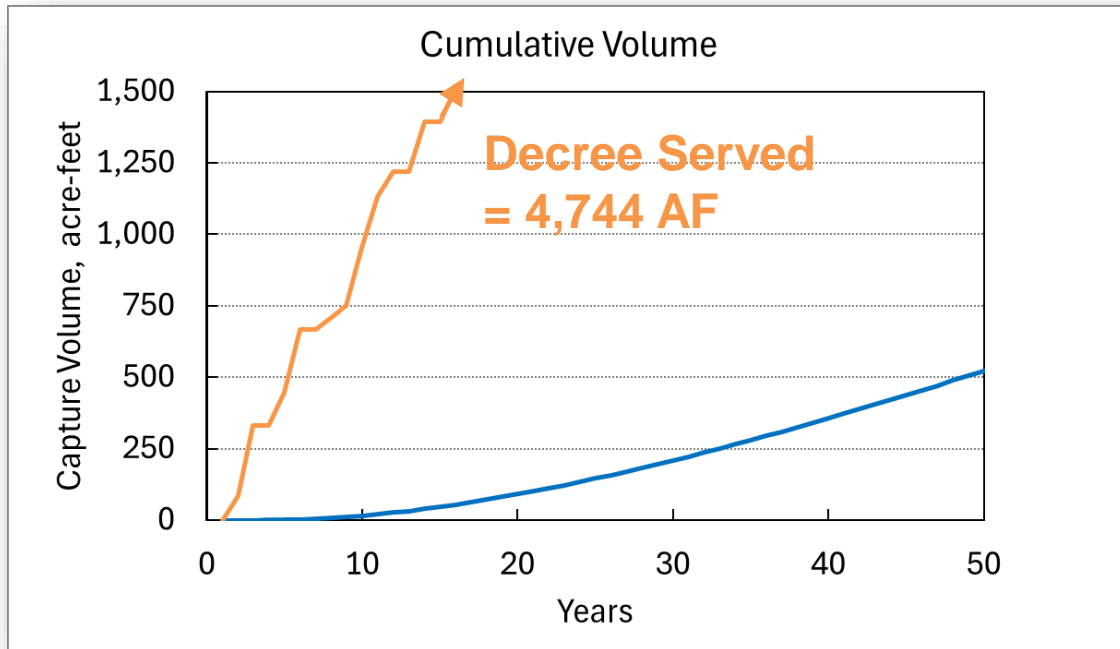
40 of 50 years successfully offset.



DECREE WATER OFFSET – WETNESS FACTOR FOR A VERY JUNIOR DECREE

For a 1921 Lower Harvest. A duty of 391 AF is needed:

$$WF_{1863LH} = \frac{17.5 \text{ AF}}{391 \text{ AF}} = 4.4\%$$



Cumulative Offset volume >> Capture Liability



40 of 50 years successfully offset.



DECREE WATER AS OFFSET – TWO EXAMPLE PERMITS – 92433 (SHOWN HERE) & 90379

Application No. 92433

APPLICATION FOR PERMISSION TO CHANGE POINT OF DIVERSION, MANNER OF USE AND PLACE OF USE OF THE PUBLIC WATERS OF THE STATE OF NEVADA HERETOFORE APPROPRIATED

THIS SPACE FOR OFFICE USE ONLY

Date of filing in State Engineer's Office FEB 18 2023

Returned to applicant for correction _____

Corrected application filed FEB 18 2023 Map filed _____

hereby make(s) application for permission to change the

Point of diversion Place of use Manner of use of a portion

of water heretofore appropriated under (Identify existing right by Permit, Certificate, Proof or Claim Nos. If Decreed, give title of Decree and identify right in Decree)

Humboldt River Decree Proof 00446.

1. The source of water is Rabbit Creek
Name of stream, lake, underground, spring or other sources.

2. The amount of water to be changed 0.149 cfs 36.5 afs with a priority date of 1872
Give diversion rate in cubic feet per second (CFS) AND duty in acre-feet annually (AFA)

3. The water to be used for Instream flow to replace captured water by the well under the application for being filed concurrently herewith, 92432
Irrigation, power, mining, commercial, etc. If for stock state number and kind of animals. Must limit to one major use.

4. The water heretofore used for As Decreed
If for stock state number and kind of animals.

5. The water is to be diverted at the following point (Describe as being within a 40-acre subdivision of public survey and by course and distance to a found section corner. If on unsurveyed land, it should be so stated.)
Water to be administered for non-diversion in Rabbit Creek, as Decreed under Humboldt River Decree Proof 00446

Point of diversion Place of use Manner of use of a portion

of water heretofore appropriated under (Identify existing right by Permit, Certificate, Proof or Claim Nos. If Decreed, give title of Decree and identify right in Decree)

Humboldt River Decree Proof 00446.

1. The source of water is Rabbit Creek
Name of stream, lake, underground, spring or other sources.

2. The amount of water to be changed 0.149 cfs 36.5 afs with a priority date of 1872
Give diversion rate in cubic feet per second (CFS) AND duty in acre-feet annually (AFA)

3. The water to be used for Instream flow to replace captured water by the well under the application for being filed concurrently herewith, 92432
irrigation, power, mining, commercial, etc. If for stock state number and kind of animals. Must limit to one major use.

4. The water heretofore used for As Decreed
If for stock state number and kind of animals.

5. The water is to be diverted at the following point (Describe as being within a 40-acre subdivision of public survey and by course and distance to a found section corner. If on unsurveyed land, it should be so stated.)
Water to be administered for non-diversion in Rabbit Creek, as Decreed under Humboldt River Decree Proof 00446

MANAGED AQUIFER RECHARGE

MANAGED AQUIFER RECHARGE (MAR) – WHAT IS IT?

The intentional recharging of aquifers.

Rapid Infiltration Basins (RIBS)

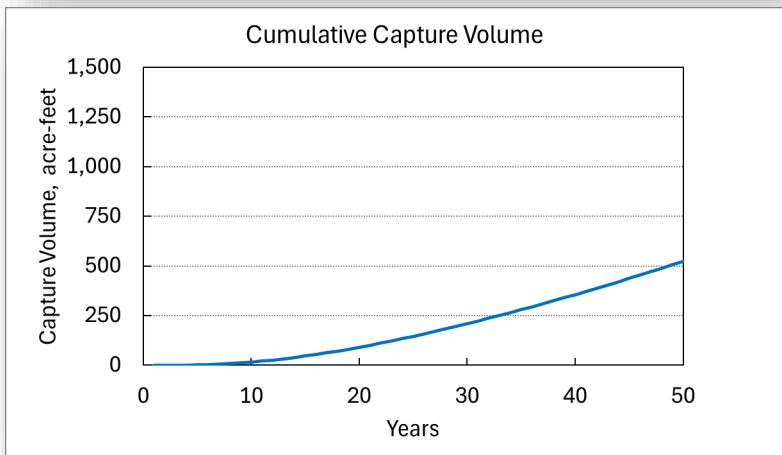
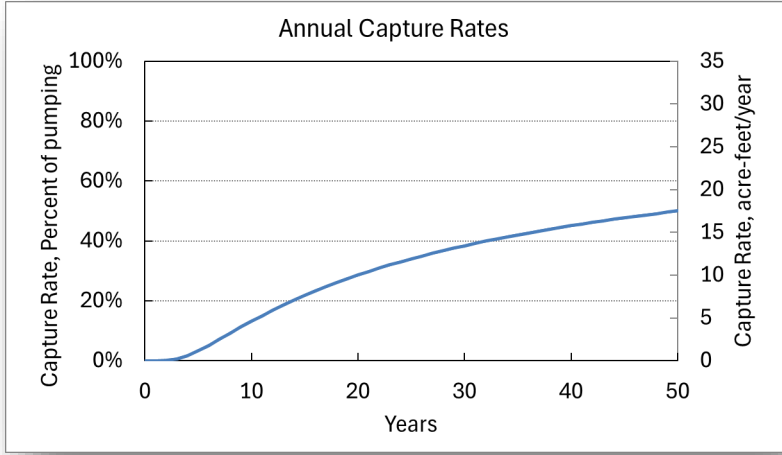


Direct Injection using Wells

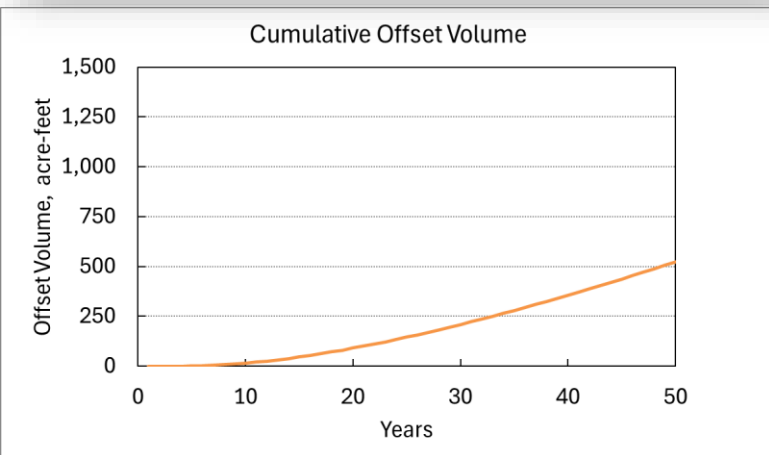
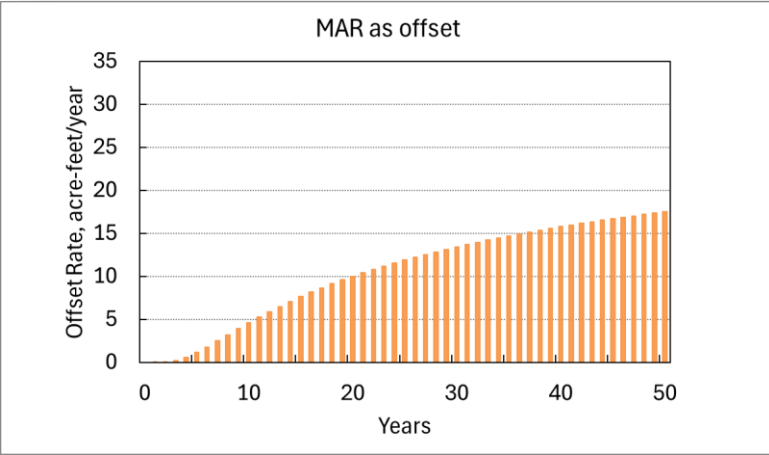


MAR AS OFFSET – WORKS SAME AS CAPTURE FROM A WELL, BUT OPPOSITE EFFECT

Hypothetical Well from earlier



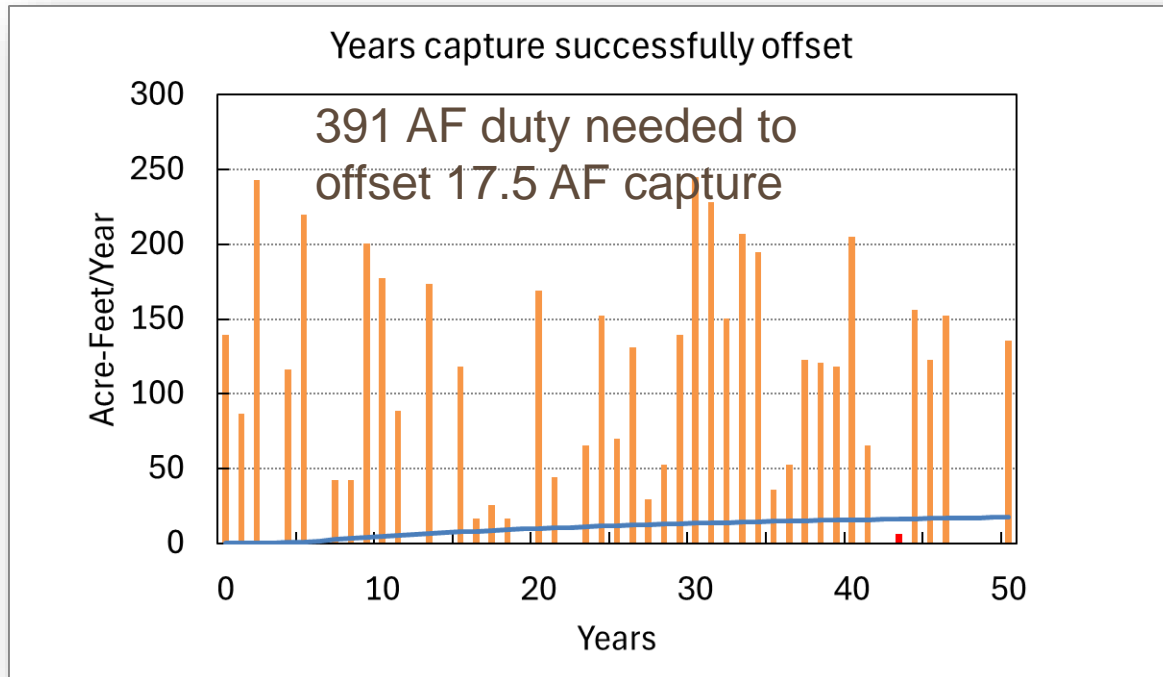
MAR at same location with same annual duty



A hypothetical RIB with infiltration of 35 AFY.
14,000 ft from the river.
 $T = 1,800 \text{ ft}^2/\text{d}$.
 S_y of 0.15

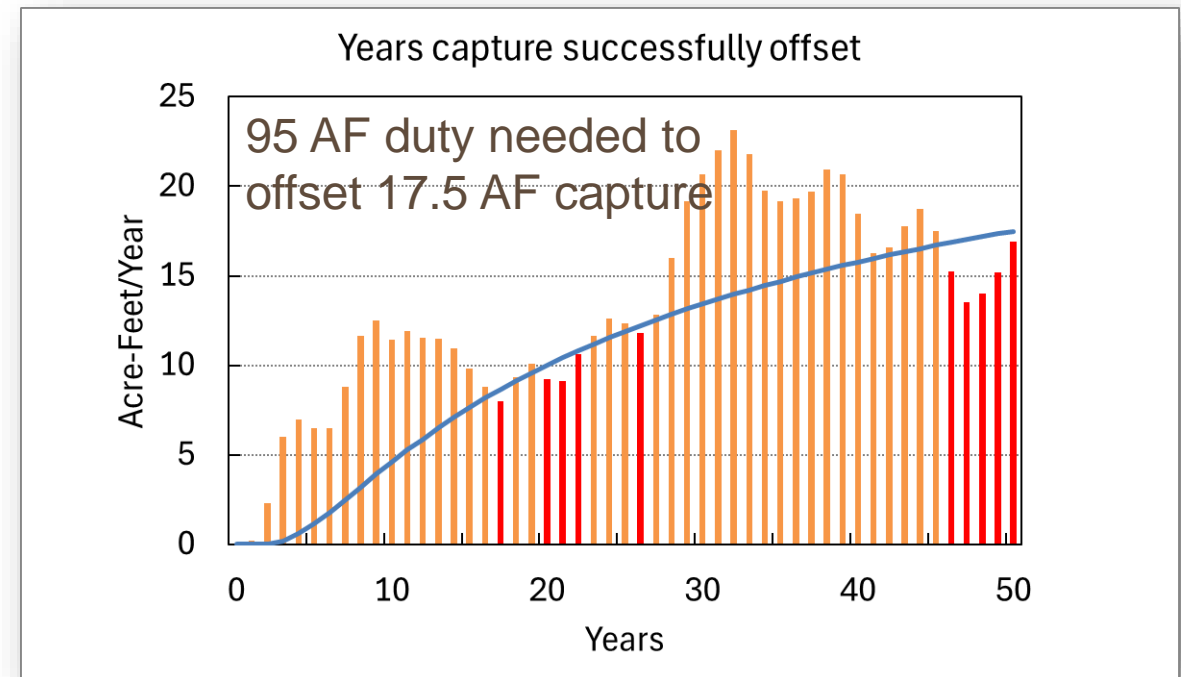
MAR AS OFFSET – USE OF JUNIOR DECREE IN MAR – 80% RULE

Recall the 1921 Lower Harvest Decree in-stream offset



Wetness Factor = 4.1%

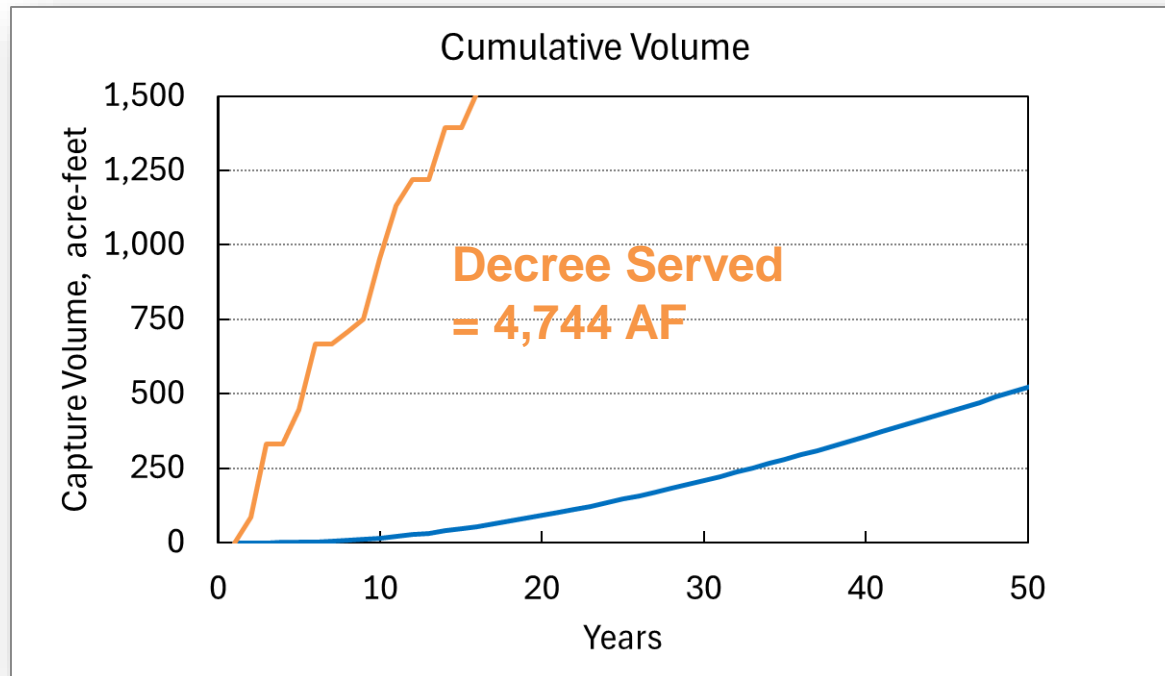
The 1921 Lower Harvest Decree placed into a RIB ~1 mile from the river.



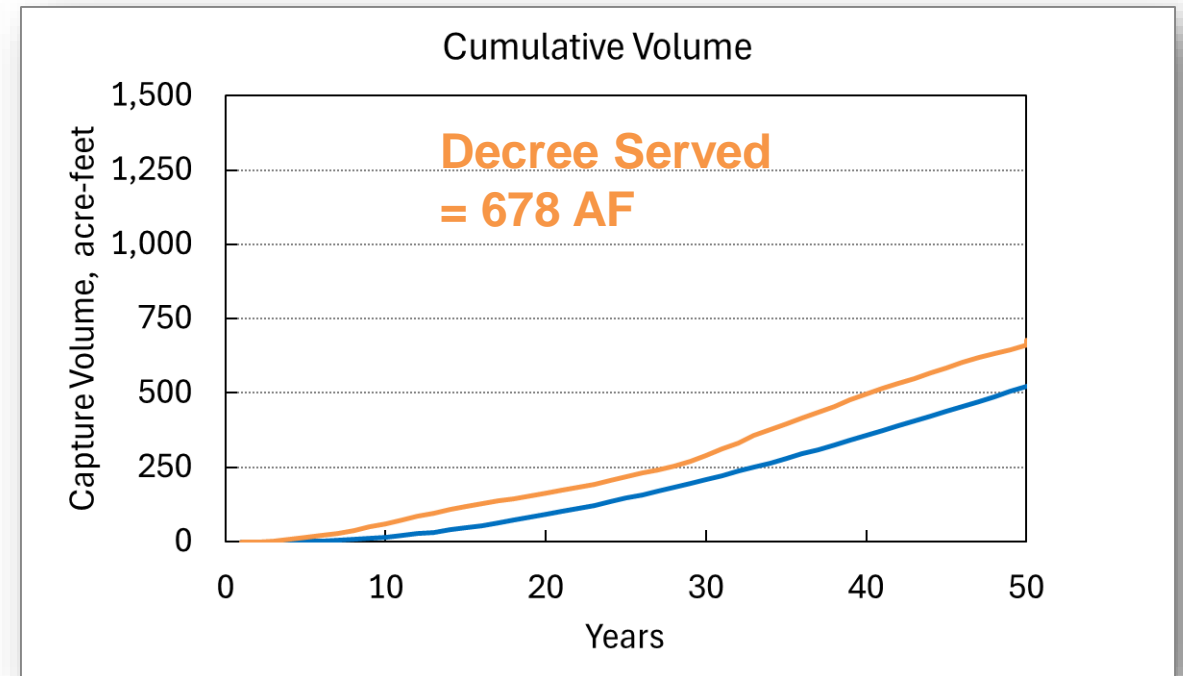
Wetness Factor = 18%

MAR AS OFFSET – USE OF JUNIOR DECREE IN MAR – CUMULATIVE

Recall the 1921 Lower Harvest Decree in-stream offset



The 1921 Lower Harvest Decree placed into a RIB ~1 mile from the river.



Example is for a RIB at ~1 mile from river;
 $T=1,800 \text{ ft}^2/\text{d}$; $S_y=0.15$

MANAGED AQUIFER RECHARGE - EXAMPLES

Elko wastewater RIBS



Spring Creek Domestic Septic Systems



Mine RIBS





Discussion

Are these concepts feasible?

Practical implementation of these concepts?

Potential concerns (financial burden, technical capacity)?

What additional tools and information might be needed?

How would offsets be registered, permitted, tracked?