

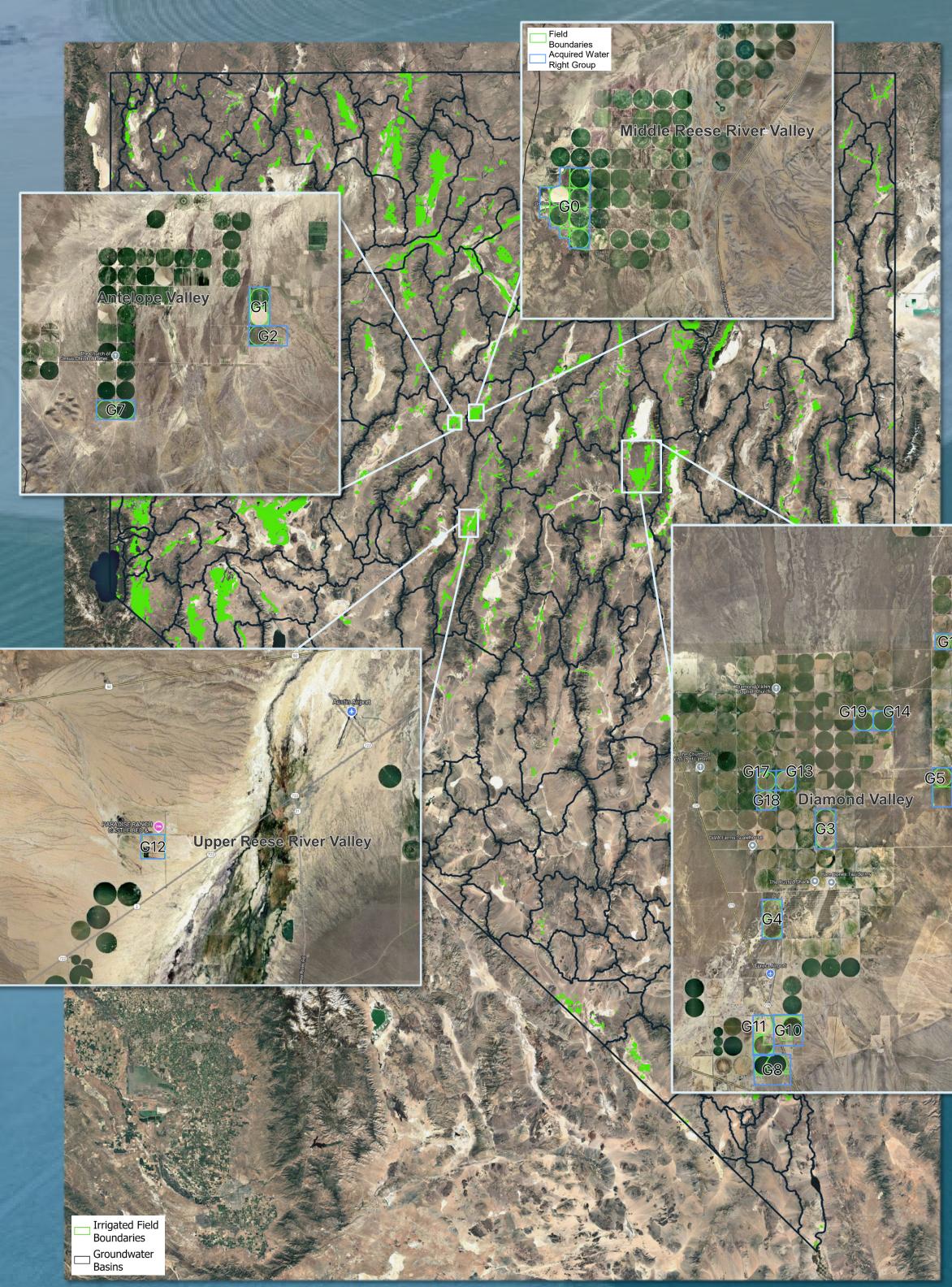
Water Right Buybacks: Quantifying How Much Water is Actually Conserved

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Project Background

Water right buybacks are becoming more common in the western U.S. due to water allocations exceeding water availability. In Nevada, \$25M of American Rescue Plan Act funding was allocated through the Department of Conservation and Natural Resources (DCNR) to develop a Voluntary Water Rights Retirement Program (VWRRP) to purchase and retire water rights in hydrographic areas that are over appropriated.

Bill draft requests (BDRs) focused on water right buybacks and water conservation are being developed and discussed for the 83rd (2025) Nevada Legislative session. A program such as this needs to demonstrate that the program can and will achieve its objective – to reduce consumptive use, conflict, and benefit groundwater basins.



Irrigated areas and groundwater right buyback places of use within four basins - Upper Reese, Antelope, Middle Reese, and Diamond Valley. Water right places of were grouped (G0-G19) based on water right permits.

Objectives

- Assess how much groundwater pumping for irrigation has occurred from permitted places of use (POUs) participating in the VWRRP
- Quantify and compare historical pumping to purchased water rights for POUs that are participating in the VWRRP
- Identify differences between wet water (pumping) and paper water (acquired water rights) and quantify the basin benefit.
- Demonstrate the use of Nevada Water Initiative science and illustrate POUs that would be optimal for VWRRP, such as POUs where historical pumping has been maximized for irrigation over the long-term and is near an area of conflict.

Nevada Water Initiative, Datasets, & Methods

The Nevada Water Initiative (NWI) - The Nevada Division of Water Resources, collaborating with Desert Research Institute (DRI) and United States Geological Survey (USGS), created the NWI to provide baseline science to improve understanding of water availability and use across the state.

The NWI provides a "science toolbox" of approaches and datasets that can inform programs such as water right buybacks and answer questions like: **OPEN**

"How much pumping for irrigation occurred over last 5 to 10 years?"



"What is the conserved consumptive use and benefit to the basin from buybacks?" "Which fields have the highest use and can reduce conflict the most through buybacks?"

Datasets - Field boundaries, water rights and places of use, satellite-based evapotranspiration (ET), and climate data was used to estimate pumping. NDWR pumping, purchased water rights (i.e. "Acquired Duty"), and costs were obtained from VWRRP tables provided by DCNR. Acquired water rights were grouped by owner and permit areas (G0-G19).

Methods - Landsat-based OpenET ET data was spatially averaged to field boundaries, and consumptive use was computed for each field from 2013-2023 as annual ET minus effective precipitation (precipitation that is used by the crop). Field-level pumping volumes ([Field Net ET (ft/yr) / Irrigation Efficiency] * Field Area (acres)) were summed for fields that intersected with VWRRP POU water right groupings and were compared to acquired water right duties and NDWR pumping volumes.

	Basin	Priority Da	e Permit No	. Permit Status	Seller Name/Corporation	Permit Duty (AFA)	TCD (Y/N)	Additive Portion (AFA)	5-yr Pumping (AFA)	Total Cost	Seller Total
	Middle Reese River Valley - 058	18-Jul-60	24432	Certificated		128.4	Y	128.4	0.07	\$115,560.00	contra rotar
	Middle Reese River Valley - 058		78174	Permit		610.48	Y	610.48	1,820.34	\$549,432.00	
	Middle Reese River Valley - 058		72434	Permit		1,191.88	Y	1,191.88	4,472.47	\$1,072,692.00	
GO -	Middle Reese River Valley - 058		72435	Permit		1,191.88	Y	0	See Permit 72434	\$0.00	
	Middle Reese River Valley - 058		25402	Certificated		597.56	Y	597.56	1,858.58	\$537,804.00	
	Middle Reese River Valley - 058		88604	Permit		643	Y	643	788.05	\$578,700.00	
	Middle Reese River Valley - 058		78175	Permit		397.77	Y	0	867.13	\$0.00	
	Middle Reese River Valley - 058		78176	Permit		504.35	Y	504.35	See Permit 78175	\$453,915.00	
	Middle Reese River Valley - 058	03-Oct-22	92178	Permit		2171.91	Y	0	953.81	\$0.00	\$3,308,
G12					Total Combined Duty	3,675.67		TCD Total 5-yr Pumpage TCD 5-yr % Pumpage	10,760.45 58.55		
JI Z	Upper Reese River Valley - 056	27-Apr-59	17955	Certificated	The Hardy Family Trust	614	N	314	114.97	\$109,900.00	\$109,
	Basin			-	Seller Name/Corporation		TCD (Y/N)	Additive Portion (AFA)	5-yr Pumping (AFA)	Total Cost	Seller Tota
							V				
	Antelope Valley - 057	07-Oct-60	77926	Certificated		96.48	T	96.48	0.00	\$86,832.00	4
	Antelope Valley - 057 Antelope Valley - 057	07-Oct-60 07-Oct-60	74901	Certificated Permit		96.48 87.12	Y	96.48 87.12	0.00 See Permit 56716	\$86,832.00	-
21			-				Y Y Y				-
G1 -	Antelope Valley - 057	07-Oct-60	74901	Permit		87.12	Y Y Y	87.12	See Permit 56716	\$78,408.00	-
G1 -	Antelope Valley - 057 Antelope Valley - 057	07-Oct-60 16-Feb-61	74901 73657	Permit Certificated		87.12 416.72	Y Y Y Y Y	87.12 416.72	See Permit 56716 2221.75	\$78,408.00 \$375,048.00	
G1 -	Antelope Valley - 057 Antelope Valley - 057 Antelope Valley - 057	07-Oct-60 16-Feb-61 16-Feb-61	74901 73657 56716	Permit Certificated Certificated		87.12 416.72 623.95	Y Y Y Y Y	87.12 416.72	See Permit 56716 2221.75 254.63	\$78,408.00 \$375,048.00 \$0.00 \$0.00	
G1 -	Antelope Valley - 057 Antelope Valley - 057 Antelope Valley - 057 Antelope Valley - 057	07-Oct-60 16-Feb-61 16-Feb-61 16-Feb-61	74901 73657 56716 85935	Permit Certificated Certificated Permit		87.12 416.72 623.95 107.26	Y Y Y Y Y Y	87.12 416.72 0 0	See Permit 56716 2221.75 254.63 See Permit 73657	\$78,408.00 \$375,048.00 \$0.00	
-	Antelope Valley - 057 Antelope Valley - 057 Antelope Valley - 057 Antelope Valley - 057 Antelope Valley - 057	07-Oct-60 16-Feb-61 16-Feb-61 16-Feb-61 16-Feb-61	74901 73657 56716 85935 56717	Permit Certificated Certificated Permit Certificated	Total Combined Duty	87.12 416.72 623.95 107.26 212.68	Y Y Y Y Y Y	87.12 416.72 0 0 212.68	See Permit 56716 2221.75 254.63 See Permit 73657 1127.81	\$78,408.00 \$375,048.00 \$0.00 \$0.00 \$191,412.00	
-	Antelope Valley - 057 Antelope Valley - 057	07-Oct-60 16-Feb-61 16-Feb-61 16-Feb-61 16-Feb-61 16-Feb-61 04-Apr-74	74901 73657 56716 85935 56717 85936 77920	Permit Certificated Certificated Permit Certificated Permit Permit	Total Combined Duty	87.12 416.72 623.95 107.26 212.68 108.2 921.20 1,163.24	Y Y Y Y Y Y	87.12 416.72 0 0 212.68 108.2 TCD Total 5-yr Pumpage	See Permit 56716 2221.75 254.63 See Permit 73657 1127.81 See Permit 56717 3,604.19	\$78,408.00 \$375,048.00 \$0.00 \$0.00 \$191,412.00	\$82
G1 - G2 -	Antelope Valley - 057 Antelope Valley - 057	07-Oct-60 16-Feb-61 16-Feb-61 16-Feb-61 16-Feb-61 16-Feb-61	74901 73657 56716 85935 56717 85936	Permit Certificated Certificated Permit Certificated Permit	-	87.12 416.72 623.95 107.26 212.68 108.2 921.20 1,163.24 1,163.24	Y Y Y Y Y Y Y	87.12 416.72 0 0 212.68 108.2 TCD Total 5-yr Pumpage TCD 5-yr % Pumpage 0 1,163.24	See Permit 56716 2221.75 254.63 See Permit 73657 1127.81 See Permit 56717 3,604.19 78.25	\$78,408.00 \$375,048.00 \$0.00 \$191,412.00 \$97,380.00	\$82
-	Antelope Valley - 057 Antelope Valley - 057	07-Oct-60 16-Feb-61 16-Feb-61 16-Feb-61 16-Feb-61 16-Feb-61 04-Apr-74	74901 73657 56716 85935 56717 85936 77920	Permit Certificated Certificated Permit Certificated Permit Permit	Total Combined Duty Total Combined Duty	87.12 416.72 623.95 107.26 212.68 108.2 921.20 1,163.24	Y Y Y Y Y Y Y	87.12 416.72 0 0 212.68 108.2 TCD Total 5-yr Pumpage TCD 5-yr % Pumpage 0	See Permit 56716 2221.75 254.63 See Permit 73657 1127.81 See Permit 56717 3,604.19 78.25 90.07	\$78,408.00 \$375,048.00 \$0.00 \$191,412.00 \$97,380.00 \$1,046,916.00	\$82

Water Right and Cost Summaries – VWRRP permits were used to identify POUs, respective field boundaries, and summarize NDWR and OpenET pumping and costs by total and per acre-foot volumes for each water right acquisition group. The "Additive Portion" is the "Acquired Duty."

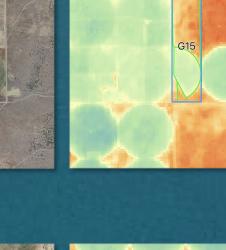
Comparison of Acquired Water Rights vs. Historical Pumping

Satellite-based pumping [(OpenET ET – Effective PPT) / Field Efficiency] compared to NDWR pumping and acquired water rights

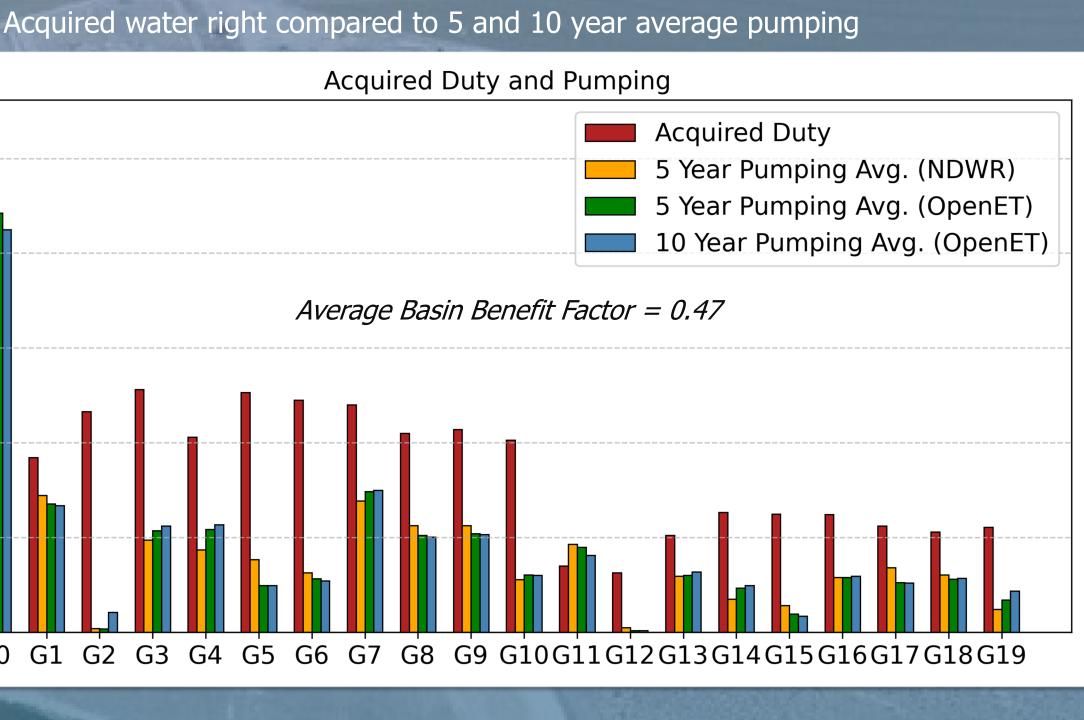


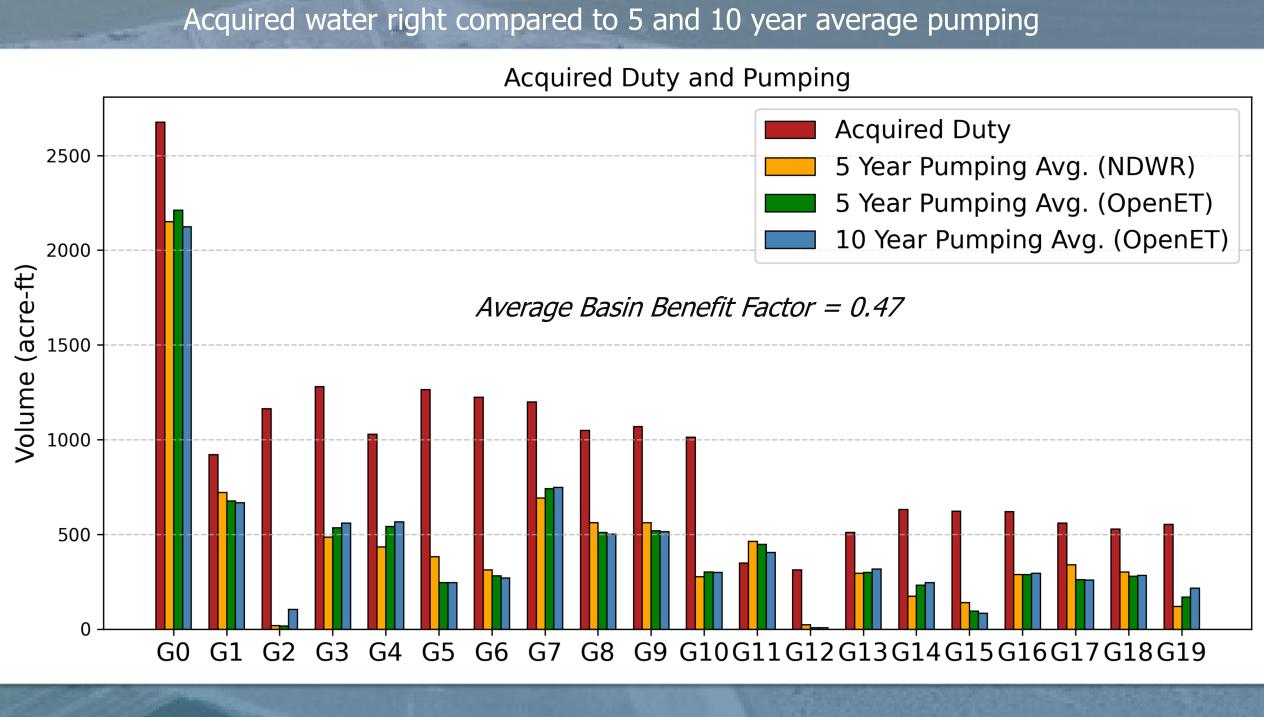
Total & Per Acre-Foot Cost Paper = Total Cost / Acquired Duty Wet = Total Cost / NDWR Pumping





Acquired water rights (paper water) and pumping (wet water) was summarized for each VWRPP and a Basin Benefit Factor (BBF = Pumping / Acquired Water Right) was computed. Ideally the BBF is near 1.

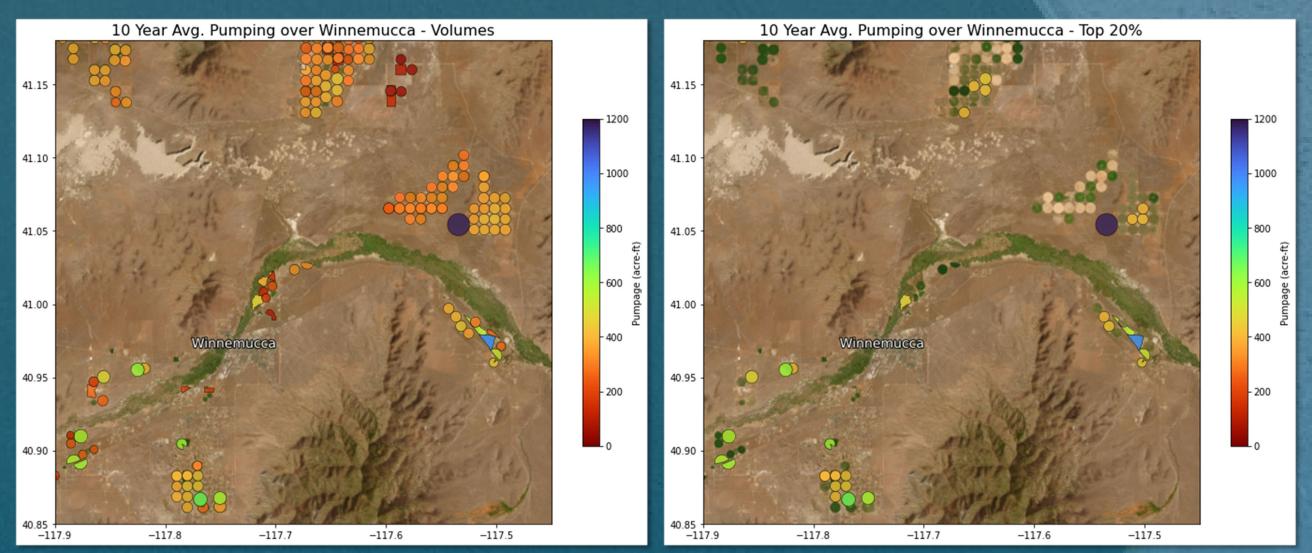




Total Acquired Water Right Duty (Paper Water) Total 5 Year Avg. NDWR Pumping (Wet Water) Total 5 Year Avg. OpenET Pumping (Wet Water) Total 10 Year Avg. OpenET Pumping (Wet Water)

Identifying & Maximizing Basin Benefit

Agricultural fields where historical water use has been maximized over the long-term and located in areas of conflict can be easily identified from satellite-based pumping. VWRRP purchases should aim to maximize the BBF.



Conclusion

A water rights buyback program needs to be supported by science so the program can and will achieve its objectives. Almost all POUs participating in the VWRRP have used substantially less water than purchased ~47% on average. This difference needs to be identified and accounted for and is necessary for water budget accounting and meeting goals and objectives of the VWRRP. The NWI "science toolbox" and products fill large science and data gaps required for successful programs such as the VWRRP.

Acknowledgements

Funding provided by State of Nevada, Nevada Water Initiative. The authors thanks the OpenET team and funders for making OpenET data freely available. OpenET data was accessed and processed using Google Earth Engine. For data availability contact Justin.Huntington@dri.edu.





Buybacks, Pumping, & Basin Benefit

Acre-Feet Per Year 18,600 8,800 8,700 8,700

Fotal Cost

Cost \$900/ac-ft \$1,800/ac-ft \$1,900/ac-ft \$1,900/ac-ft

\$16,000,000

Average satellite-based field pumping volumes for 2012-2023 (left), and fields with the top 20% pumping volumes (right) near Winnemucca and areas of conflict on the Humboldt River.