2023

Groundwater Extraction Summary Report

Monterey County Water Resources Agency

June 2024

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Overview of the Groundwater Extraction Reporting Program

History of the Groundwater Extraction Reporting Program

In 1993, the Monterey County Board of Supervisors adopted Ordinances No. 3717 and 3718 that require water suppliers within Zones 2, 2A, and 2B to report water use information for groundwater extraction facilities (wells) and service connections, with a discharge pipe having an inside diameter of at least three inches, to the Monterey County Water Resources Agency (Agency).

The purpose of the Groundwater Extraction Reporting Program is to provide the Agency with the most accurate water use information available to effectively manage groundwater resources. In order to obtain accurate water pumping information, methods of directly measuring water extractions have been implemented.

The Agency collects groundwater extraction data from well operators annually for a period beginning November 1 and ending October 31 ("reporting year"). Data collection began with the 1992-1993 reporting year. Information submitted by more than three hundred well operators in Agency management zones of the Salinas Valley (Figure 1) is stored in an Agency database.

Since the adoption of Ordinance 3851, the Agency has required the annual submittal of Agricultural Water Conservation Plans, which outline the best management practices (BMPs) that are to be adopted each year by growers in the Salinas Valley. In 1996, an ordinance was passed that requires the filing of Urban Water Conservation Plans (Ordinance 3886). Developed as the urban counterpart to the agricultural water conservation plans, the plans provide an overview of the BMPs to be implemented by urban water purveyors as conservation measures.

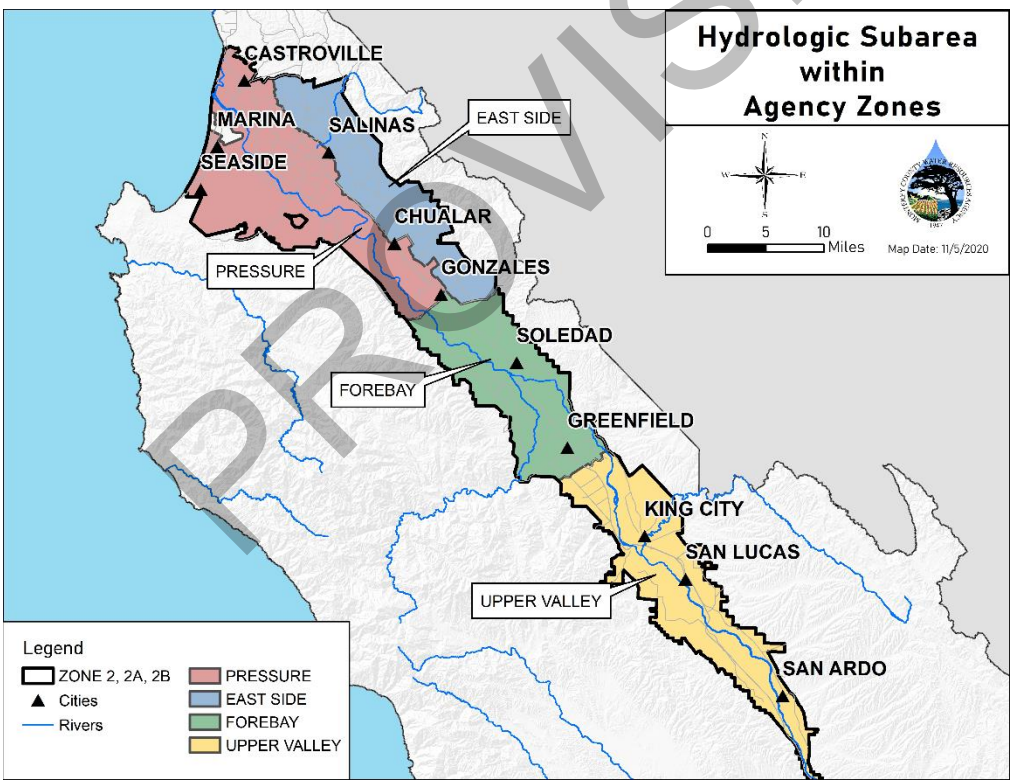


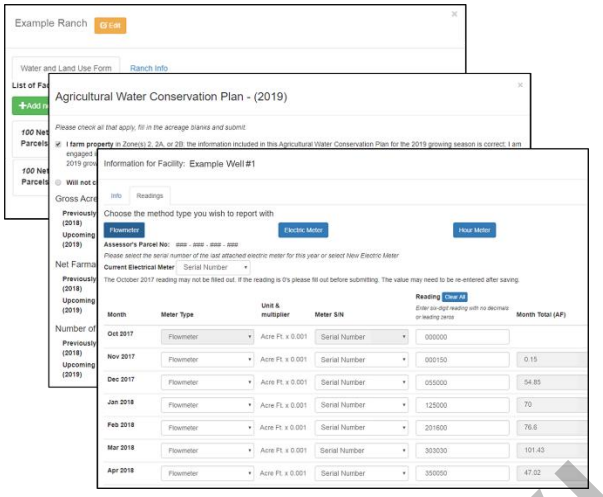
Figure 1. Hydrologic Subareas within Agency Zones 2, 2A, and 2B

For extraction reporting purposes, the Agency divides a portion of the Salinas Valley Groundwater Basin into four hydrologic subareas; Pressure, East Side, Forebay, and Upper Valley. These subareas are hydrologically and hydraulically connected, and their boundaries are defined by differences in local hydrogeology and recharge.

Groundwater Summary Report

The purpose of this report is to summarize the data submitted to the Agency by well operators in February 2024 from the following annual forms:

- Groundwater Extraction Forms (agricultural and urban)
- Water Conservation Plans (agricultural and urban)
- Water and Land Use Forms (agricultural)



The agricultural data from the groundwater extraction program covers the reporting year of November 1, 2022, through October 31, 2023; the urban data covers calendar year 2023. The agricultural and urban water conservation plans for 2024 are also summarized. This report is intended to present a synopsis of current groundwater extraction within the Salinas Valley, including agricultural and urban water conservation improvements that are being implemented to reduce the total amount of water pumped. It is not the purpose of this report to thoroughly analyze the factors that contribute to increases or decreases in pumping.

Reporting Format

Groundwater extraction data are presented in this report in units of acre-feet (AF). One acre-foot is equal to 325,851 gallons.

Reporting Methods

The Groundwater Reporting Program provides well operators with a choice of three different reporting methods: Water Flowmeter, Electrical Meter, or Hour Meter (timer). The summary of groundwater extractions presented in this report is compiled from data generated by all three reporting methods. Ordinance 3717 requires annual pump efficiency tests and/or meter calibration of each well to ensure the accuracy of the data reported. The distribution of methods used for the 2023 reporting year was: 85% Flowmeter; 15% Electrical Meter; and <1% Hour Meter.

Compliance

The Agency received Groundwater Extraction Reports from ninety-six percent (96%) of the 1,940 wells in Zones 2, 2A, and 2B of the Salinas Valley that were required to report for the 2023 reporting year. Agricultural and Urban Water Conservation Plan submittal compliance for 2023 was eighty-seven percent (87%) and ninety-eight percent (98%), respectively.

Disclaimer

While the Agency has made every effort to ensure the accuracy of the data presented in this report, it should be noted that the data are submitted by individual reporting parties. In addition, since so many factors can affect the equipment calibration, it is understood that no reporting method is 100 percent accurate. The Agency maintains strict quality assurance in the compilation, standardization, and entry of the data received. Changes to historical data may occur due to additional submittals after the due date. Rounding errors may cause the total extraction values displayed to be within 5 AF of actual totals.

Groundwater Extraction Form – Data Summary

Total Extractions by Subarea and Type of Use

All data presented in this section are derived from the agricultural and urban Groundwater Extraction Forms.

Table 1. Extraction Data by Subarea and Type of Use.

Subarea	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
Pressure	77,906	14,516	**92,422**
East Side	72,157	13,286	**85,443**
Forebay	101,050	6,748	**107,798**
Upper Valley	110,820	2,699	**113,519**
Total (AF)	**361,933**	**37,250**	**399,183**
Percent of Total	**90.7%**	**9.3%**	**100.0%**

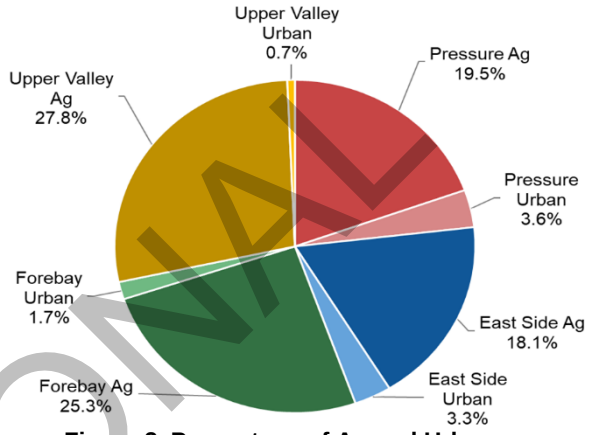


Figure 2. Percentage of Ag and Urban Extractions by Subarea.

Urban Extraction Data by City or Area

The total groundwater extractions attributed to urban use include residential, commercial, institutional, industrial, and governmental pumping, and are summarized below.

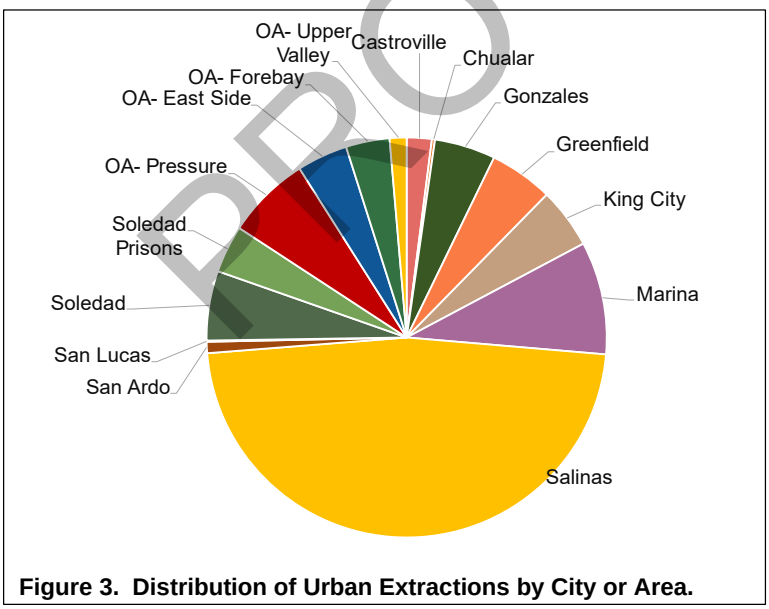


Figure 3. Distribution of Urban Extractions by City or Area.

Table 2. Urban Extractions by City or Area

City or Area	Urban Pumping (AF)	Percentage
Castroville	751	2.02%
Chualar	93	0.25%
Gonzales	1,834	4.93%
Greenfield	1,914	5.15%
King City	1,817	4.88%
Marina	3,394	9.12%
Salinas	17,628	47.39%
San Ardo	339	0.91%
San Lucas	36	0.10%
Soledad	2,092	5.62%
Soledad Prisons	1,429	3.84%
OA- Pressure	2,525	6.79%
OA- East Side	1,524	4.10%
OA- Forebay	1,313	3.53%
OA- Upper Valley	507	1.36%
Total	**37,196**	**100.00%**

OA=Other Area

Total Groundwater Extractions in Zones 2, 2A, 2B

This figure provides a spatial representation of groundwater extractions within Zones 2, 2A, and 2B for the 2023 reporting year. The figures and tables on the next six pages provide extraction information by subarea. The number of wells shown in Figures 4 to 15 may be different than the total number of wells in the program, as stated on Page 2. This is due to delinquent extraction reports and the exact location of 2 wells being unknown.

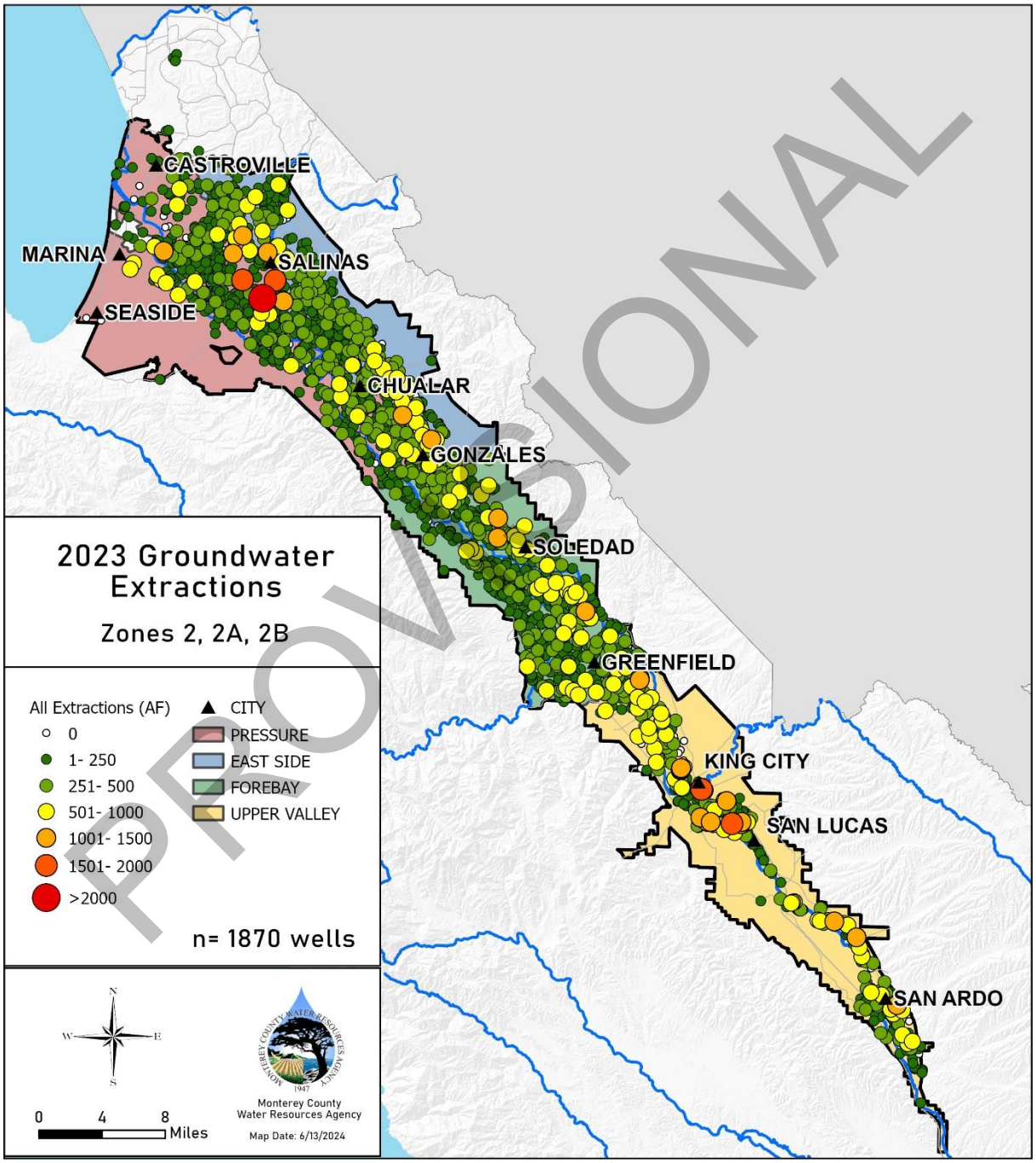


Figure 4. 2023 Groundwater Extractions (AF).

Pressure Subarea – Extraction Data

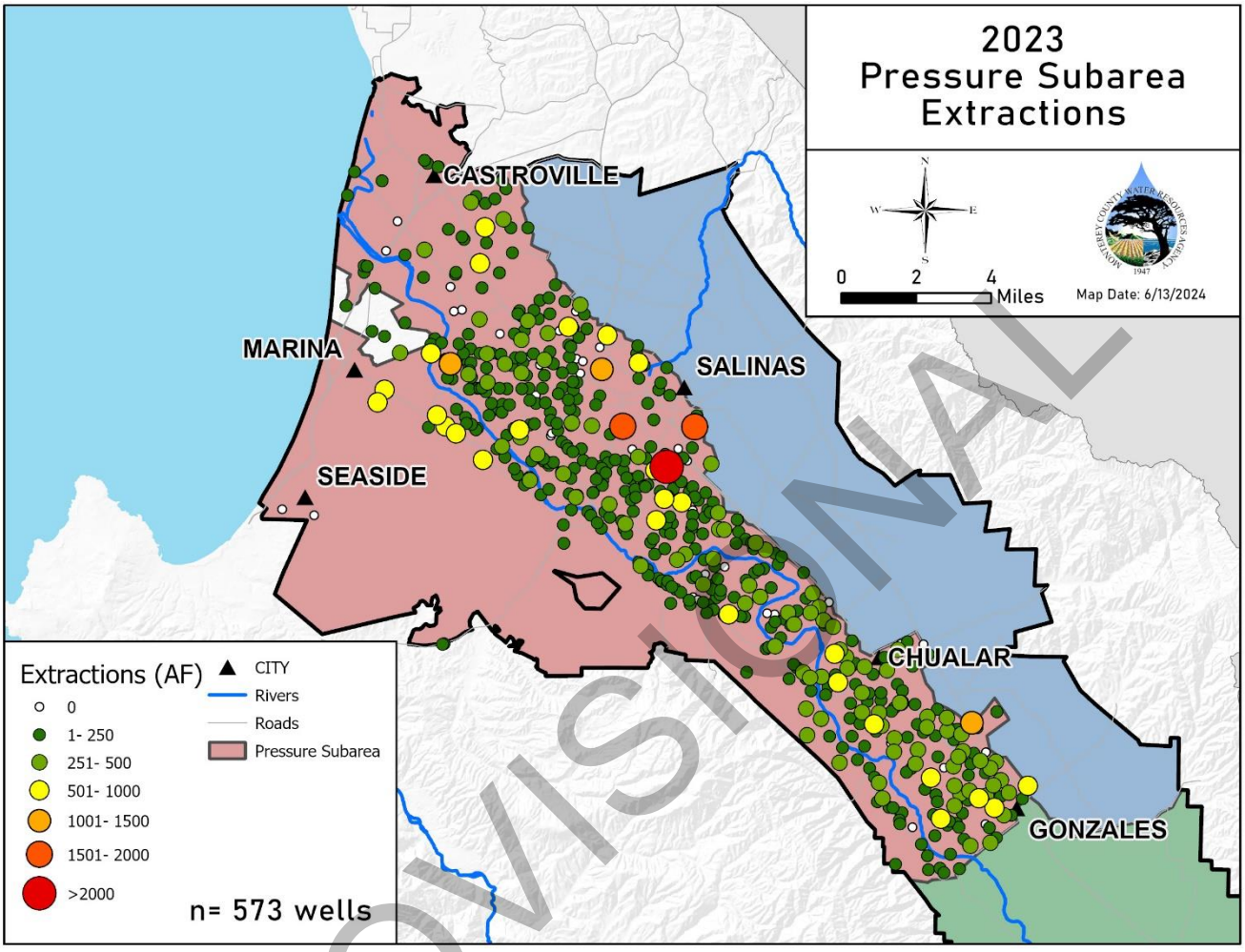


Figure 5. 2023 Groundwater Extractions in the Pressure Subarea.

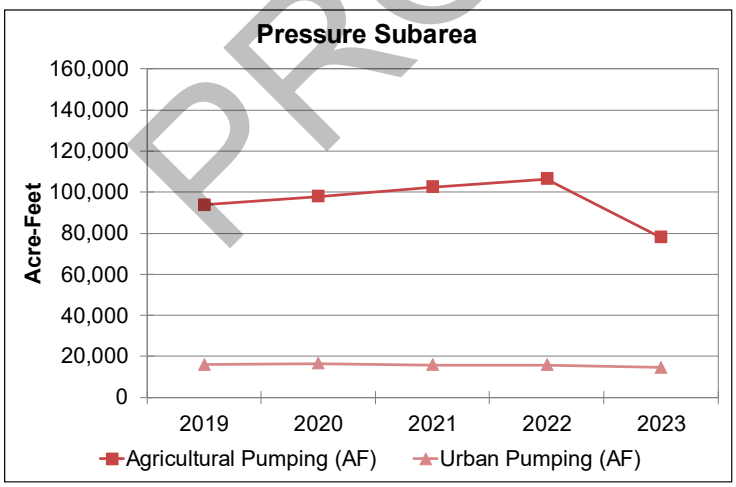


Figure 6. Agricultural and Urban Extractions (AF) in the Pressure Subarea 2019-2023.

Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2023	77,906	14,516	92,422
2022	106,493	15,847	122,340
2021	102,435	15,785	118,220
2020	97,821	16,452	114,273
2019	93,829	15,885	109,714

Table 3. Total, Agricultural, and Urban Extractions (AF) in the Pressure Subarea 2019-2023.

CSIP, Zone 2B and Area of Impact- Extraction Data

The Castroville Seawater Intrusion Project (CSIP) delivers recycled water from the Salinas Valley Reclamation Project, re-diverted stored reservoir water via the Salinas River Diversion Facility, and groundwater from nine supplemental wells to 12,000 acres of irrigated land in the Castroville area, referred to as Zone 2B, to reduce groundwater pumping near the coast. Pumping from non-CSIP supplemental wells (i.e. privately owned wells) has decreased since CSIP began operations in 1998 but is still occurring (Figure 8). The Area of Impact encompasses the region where chloride concentrations in the 180-Ft and 400-Ft Aquifers are 250 mg/L or greater. Groundwater within the Area of Impact is considered vulnerable due to the presence of pathways for seawater intrusion to migrate vertically from the impaired overlying aquifers (Figure 7, Table 4). The data shown below is a subset of the Pressure Subarea extractions on the previous page.

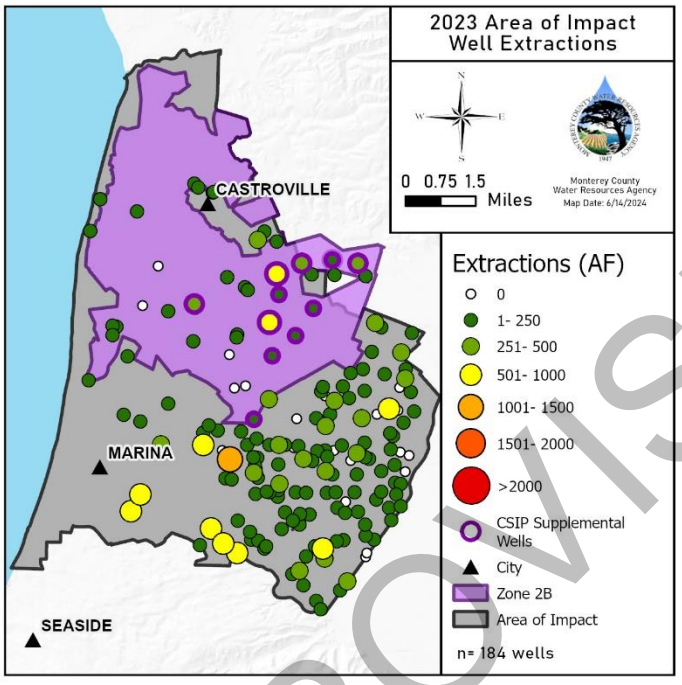


Figure 7. 2023 Groundwater Extractions (AF) in the Area of Impact.

Aquifer	Agriculture Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
180-Ft Aquifer or East Side Shallow	1,508	1	1,509
180 and 400-Ft Aquifer	1,064	303	1,367
400-Ft Aquifer or East Side Deep	11,826	1,512	13,338
Deep Aquifers	7,346	1,806	9,152
Unknown	2,507	88	2,595
Total (AF)	24,251	3,709	27,960

Table 4. 2023 Extraction Data in the Area of Impact by Aquifer and Type of Use

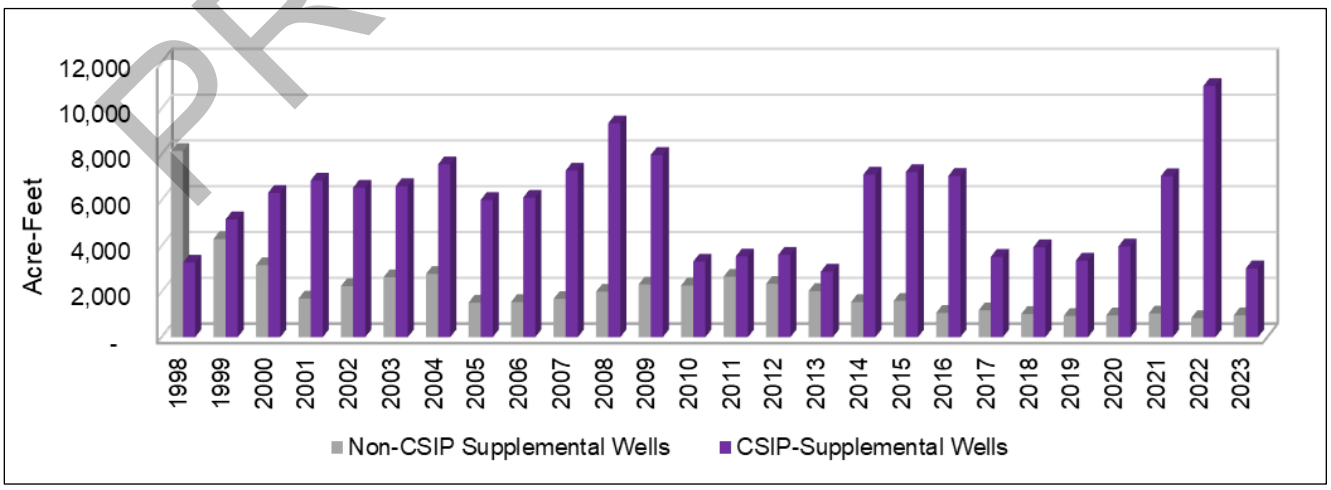


Figure 8. Groundwater Extractions in Zone 2B from CSIP and Non-CSIP Supplemental Wells, 1998-2023

Deep Aquifers – Extraction Data

The first production well in the Deep Aquifers was installed in 1974. As of December 2023, fifty-seven wells have been installed in the Deep Aquifers, with seventeen installed since 2017 (Figure 9). For the purposes of this report, wells categorized as “Deep Aquifers wells” are based on the Agency’s historical interpretation which may differ from the number of wells and associated groundwater extractions described in the Deep Aquifers Study (Montgomery & Associates, 2024). The amount of water extracted from the Deep Aquifers has increased in recent years (Figure 10, Table 5). The potential for inducing leakage from the overlying impaired aquifers is a serious concern as groundwater extractions from the Deep Aquifers continue to increase.

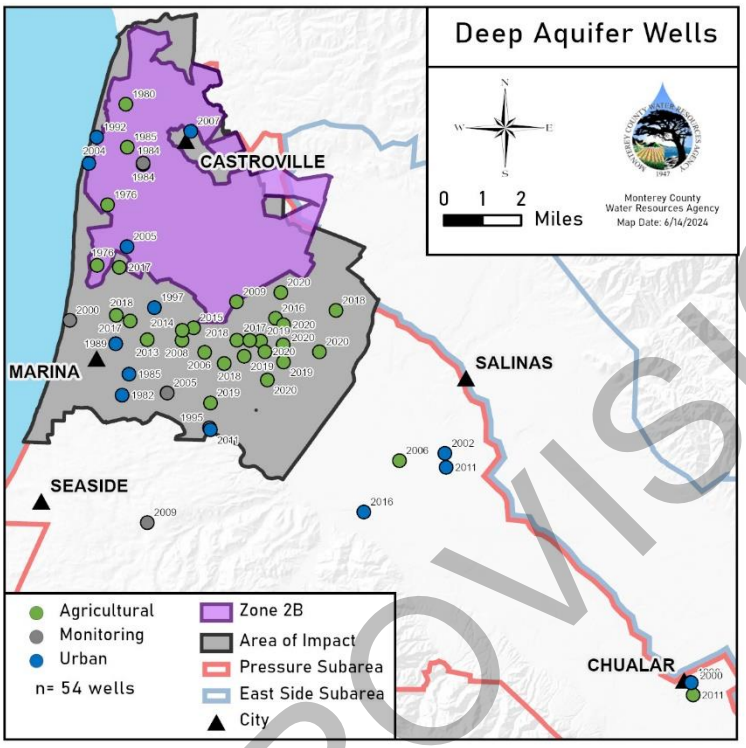


Figure 9. Deep Aquifers Wells by Year Drilled and Type of Use

Reporting Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2023	7,826	4,453	**12,279**
2022	9,599	4,154	**13,753**
2021	8,820	4,258	**13,078**
2020	6,996	4,348	**11,344**
2019	5,331	5,016	**10,347**
2018	4,855	4,790	**9,645**
2017	4,958	4,558	**9,516**
2016	4,293	4,259	**8,552**
2015	2,010	4,363	**6,373**
2014	2,031	4,404	**6,435**
2013	1,097	2,505	**3,602**
2012	1,397	2,424	**3,821**
2011	927	2,173	**3,100**
2010	982	2,236	**3,218**
2009	696	2,450	**3,146**
2008	384	2,375	**2,759**
2007	58	2,131	**2,189**
2006	0	2,341	**2,341**
2005	0	2,701	**2,701**
2004	0	2,747	**2,747**
2003	0	2,745	**2,745**
2002	0	2,416	**2,416**
2001	0	2,368	**2,368**
2000	1	2,305	**2,306**
1999	96	2,055	**2,151**
1998	1,648	1,906	**3,554**
1997	2,556	2,170	**4,726**
1996	1,990	2,137	**4,127**
1995	2,302	2,036	**4,338**
1994	2,620	1,992	**4,612**
1993	1,507	2,054	**3,561**

Table 5. Deep Aquifers Groundwater Extractions by Type of Use, 1993-2023

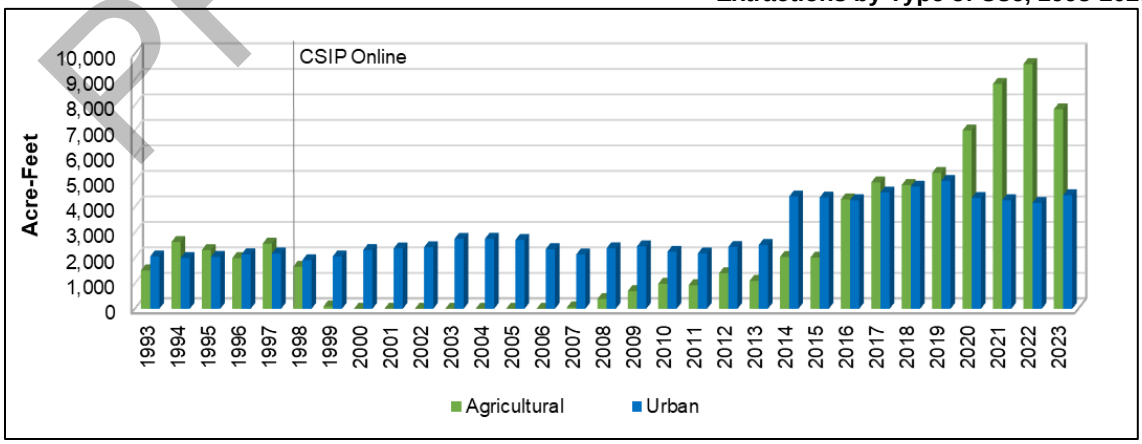


Figure 10. Deep Aquifers Groundwater Extractions by Type of Use, 1993-2023

East Side Subarea – Extraction Data

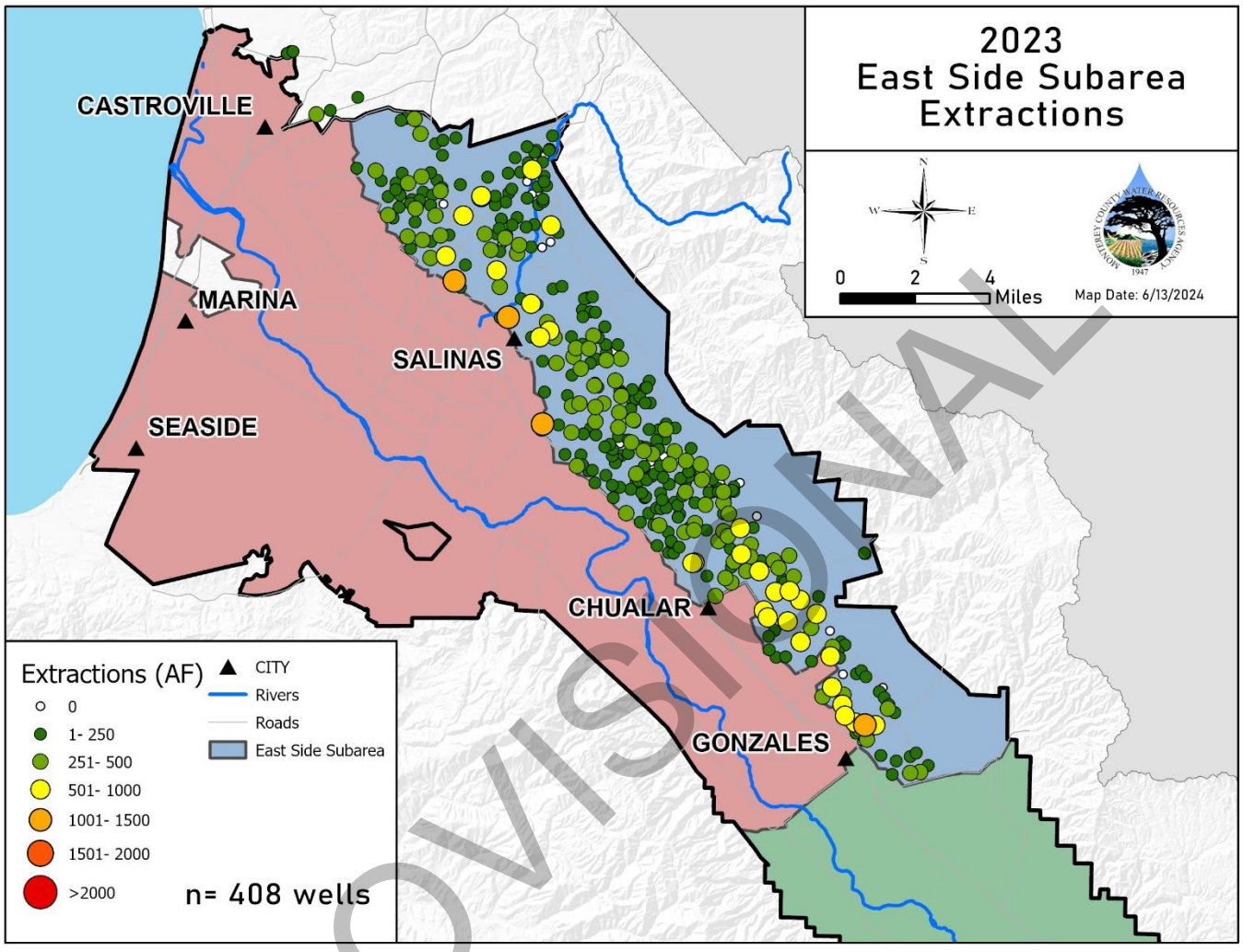


Figure 11. 2023 Groundwater Extractions in the East Side Subarea.

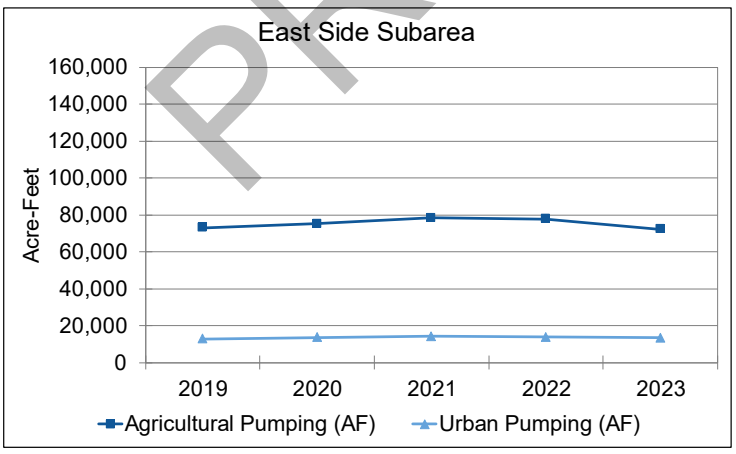


Figure 12. Agricultural and Urban Extractions (AF) in the East Side Subarea 2019-2023.

Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2023	72,157	13,286	85,443
2022	77,731	13,840	91,571
2021	78,283	14,136	92,419
2020	75,125	13,617	88,742
2019	73,006	12,822	85,828

Table 6. Total, Agricultural, and Urban Extractions (AF) in the East Side Subarea 2018-2023.

Forebay Subarea – Extraction Data

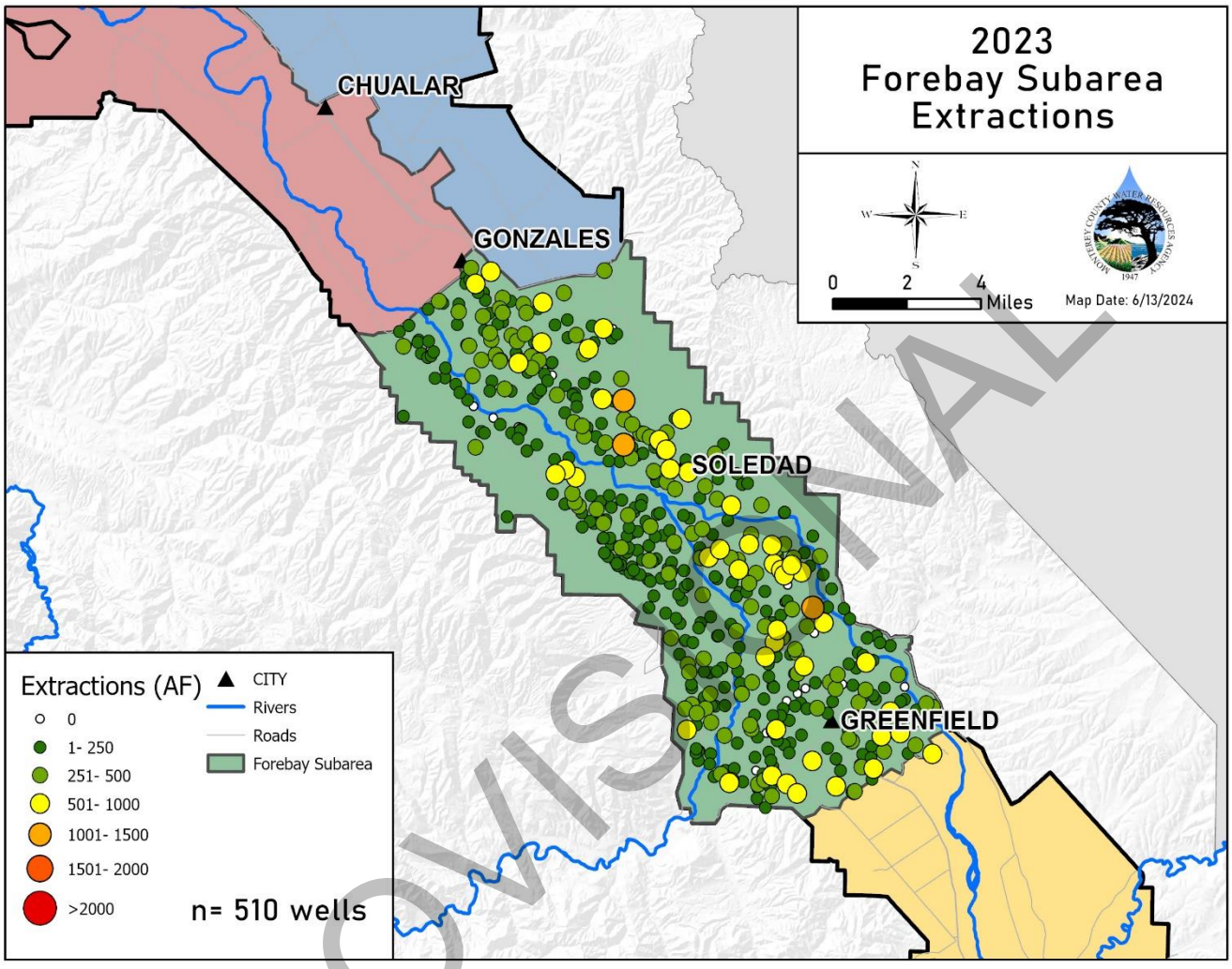


Figure 13. 2023 Groundwater Extractions in the Forebay Subarea.

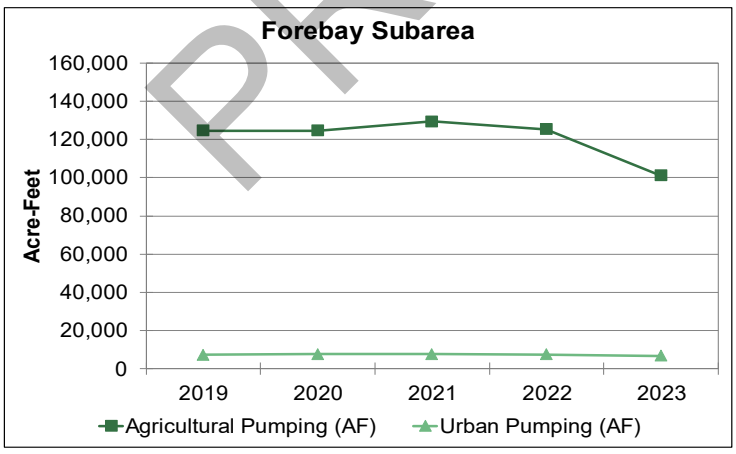


Figure 14. Agricultural and Urban Extractions (AF) in the Forebay Subarea 2019-2023.

Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2023	101,050	6,748	107,798
2022	125,341	7,544	132,885
2021	129,391	7,645	137,036
2020	124,643	7,590	132,233
2019	124,600	7,374	131,974

Table 7. Total, Agricultural, and Urban Extractions (AF) in the Forebay Subarea 2019-2023.

Upper Valley Subarea – Extraction Data

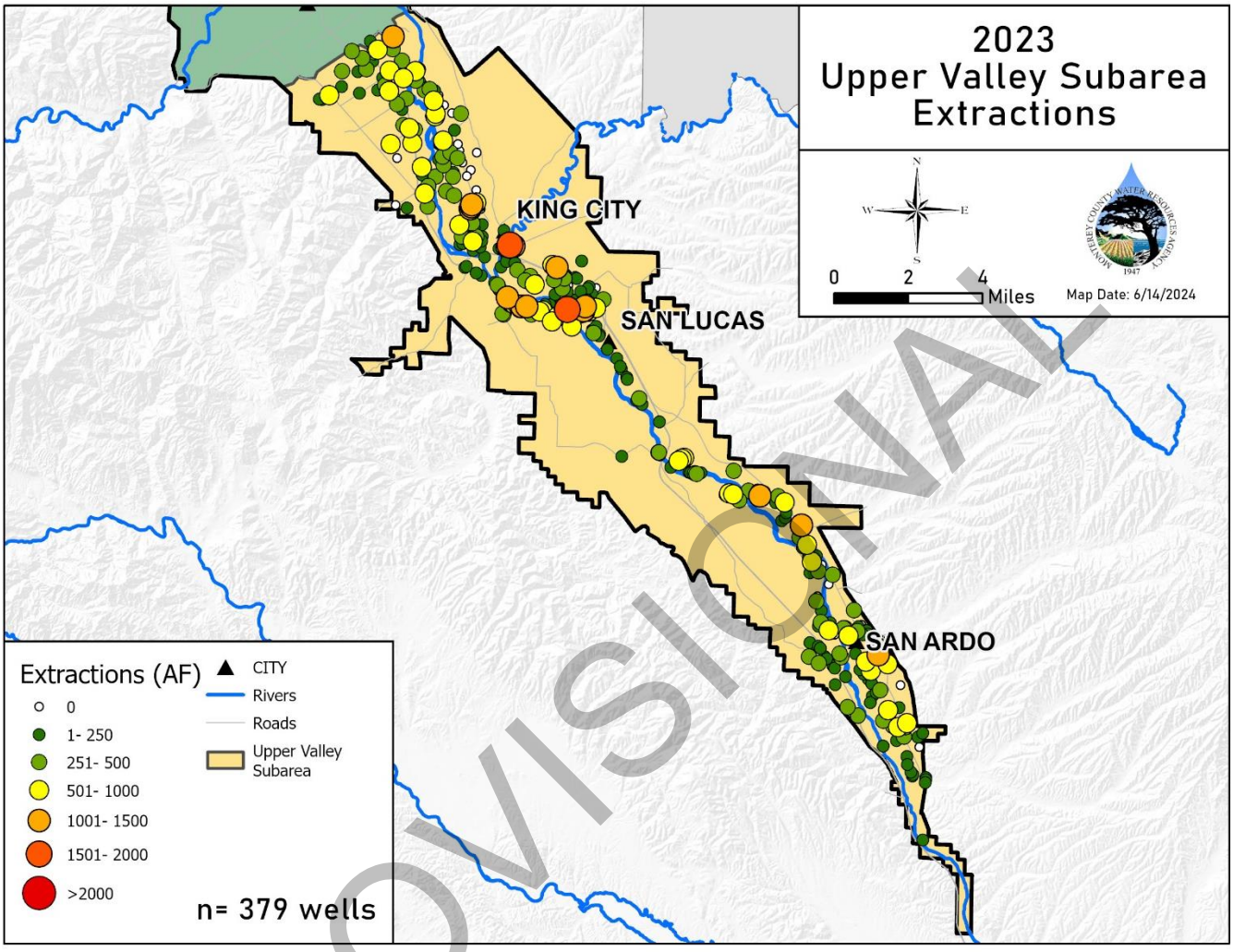


Figure 15. 2023 Groundwater Extractions in the Upper Valley Subarea

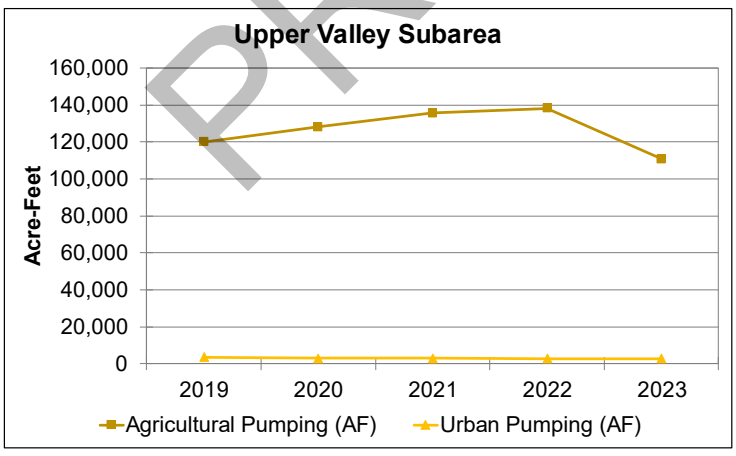


Figure 16. Agricultural and Urban Extractions (AF) in the Upper Valley Subarea 2019-2023

Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2023	110,820	2,699	113,159
2022	138,257	2,758	141,015
2021	135,596	2,987	138,583
2020	128,016	2,827	130,843
2019	120,025	3,430	123,455

Table 8. Total, Agricultural, and Urban Extractions (AF) in the Upper Valley Subarea 2019-2023.

Agricultural Water Conservation – Data Summary

The Agricultural Water Conservation Plans include information on net irrigated acreage, irrigation methods, and crop type. This information is forecasted and indicates what the grower plans to do in the upcoming year. Figure 17 and Table 9 present a breakdown of irrigation methods by crop type. Figure 18 shows the change in irrigation methods over the length of the GEMS program and Figure 19 shows the top ten Best Management Practices (BMPs) to be implemented in 2024.

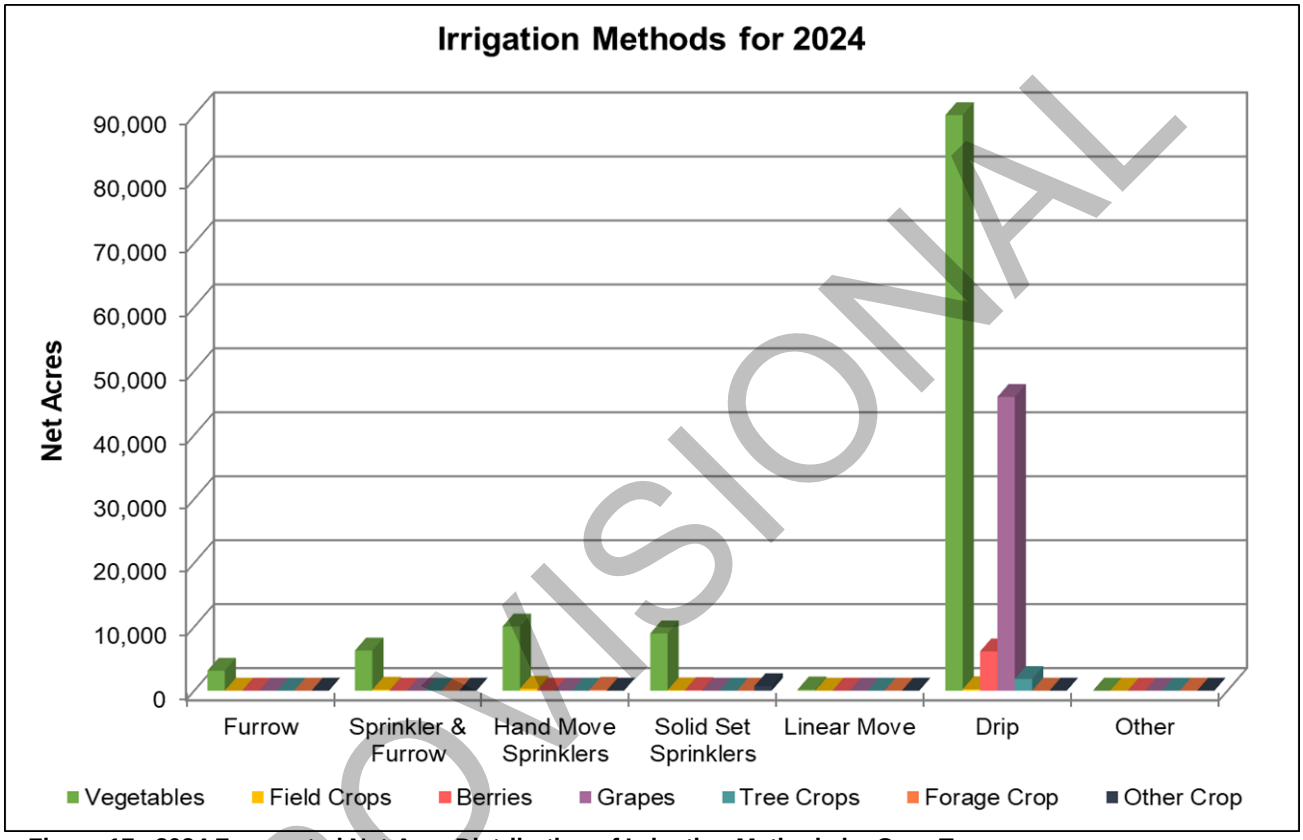


Figure 17. 2024 Forecasted Net Acre Distribution of Irrigation Methods by Crop Type.

2024	Furrow	Sprinkler & Furrow	Hand Move Sprinklers	Solid Set Sprinklers	Linear Move	Drip	Other	Total
Vegetables	3,107	6,279	10,029	8,939	194	98,653	0	127,201
Field Crops	0	152	297	48	0	230	0	727
Berries	0	0	0	74	0	6,130	0	6,204
Grapes	0	0	0	0	0	45,929	0	45,929
Tree Crops	0	0	0	0	0	1,821	0	1,821
Forage Crop	0	0	144	0	15	0	0	159
Other Crop	0	0	0	702	0	1	0	703
Unirrigated								996
Total	**3,107**	**6,431**	**10,470**	**9,763**	**209**	**152,764**	**0**	**183,741**

Table 9. Net Acres by Irrigation Method and Crop Type.

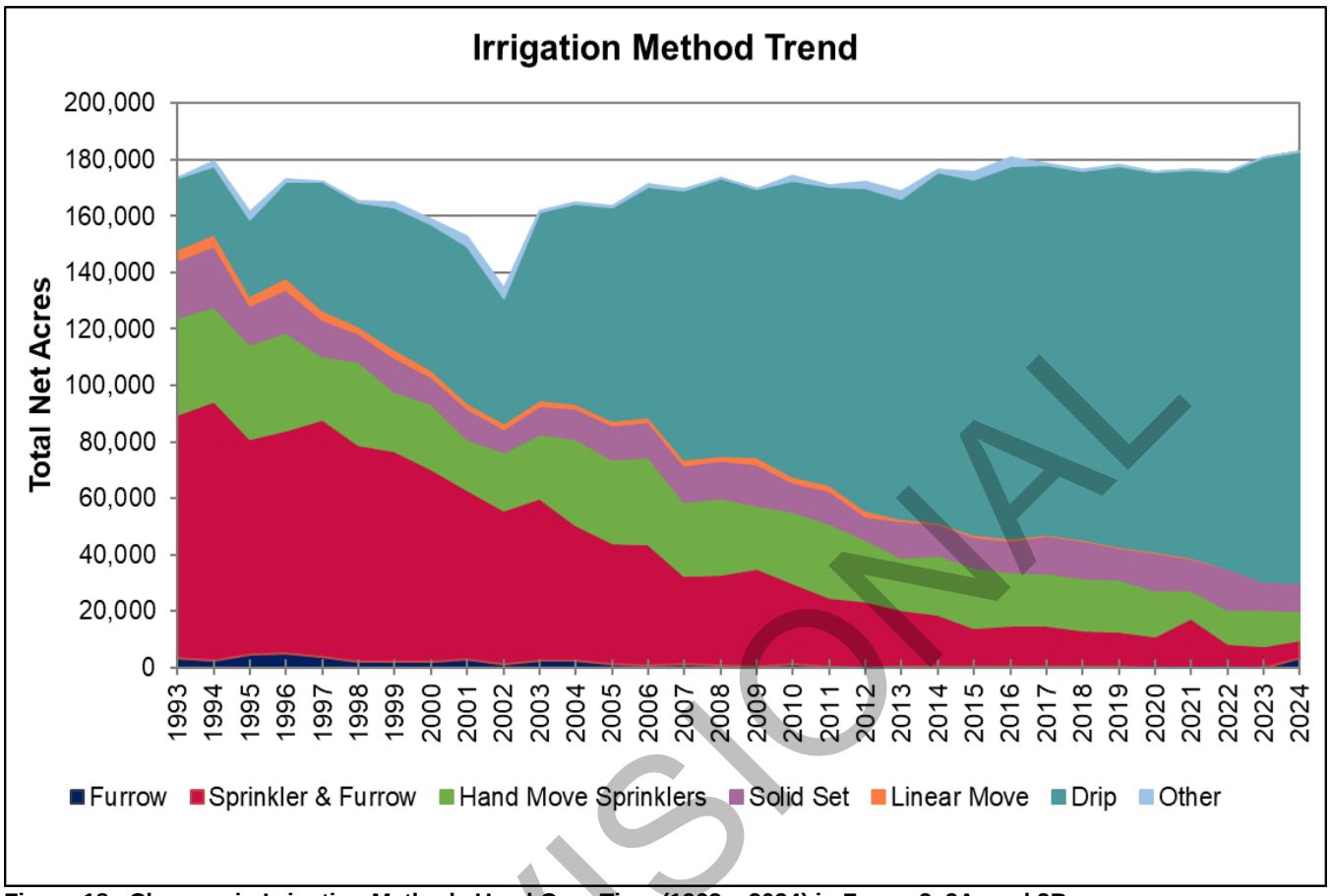


Figure 18. Changes in Irrigation Methods Used Over Time (1993 – 2024) in Zones 2, 2A, and 2B.

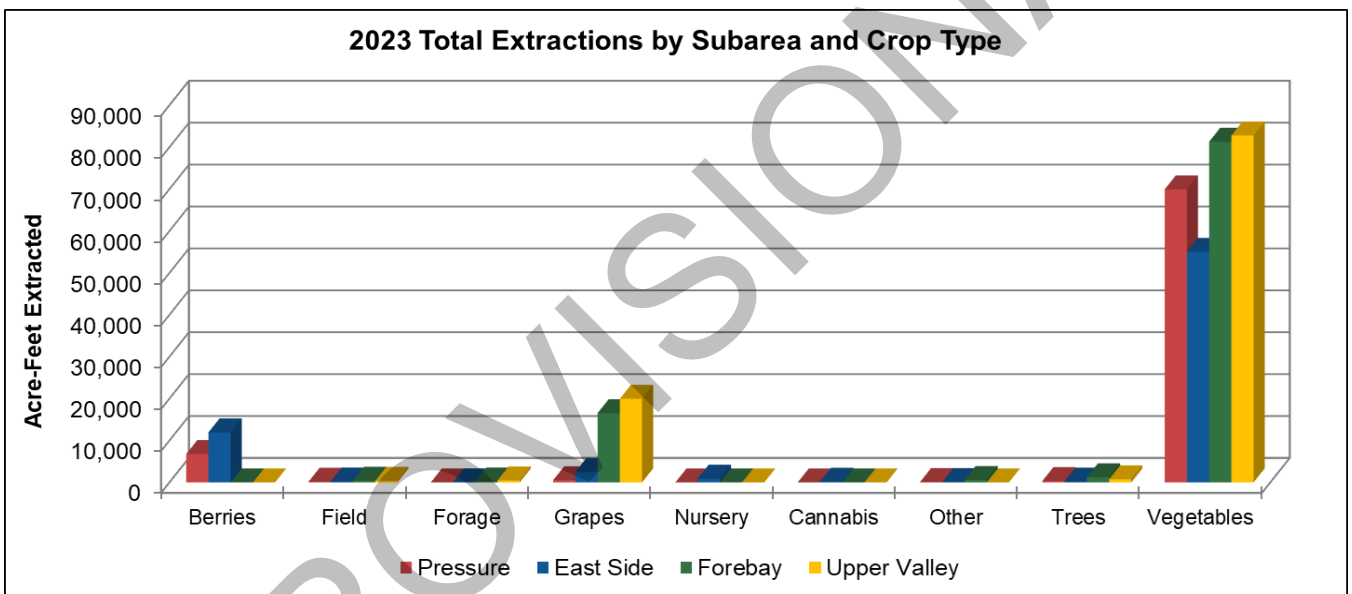
Figure 19. Top Ten BMPs Forecasted for 2024 Based on Reported Net Acres.

Water and Land Use Form – Data Summary

The following three figures show the agricultural water extracted (Figure 20), irrigated net acres (Figure 21), and amount of water used per acre (Figure 22) by hydrologic subarea and crop type based on data submitted on the Water and Land Use forms. The data account for all crop types reported and all reporting methods: water flowmeter, electrical meter, and hour meter.

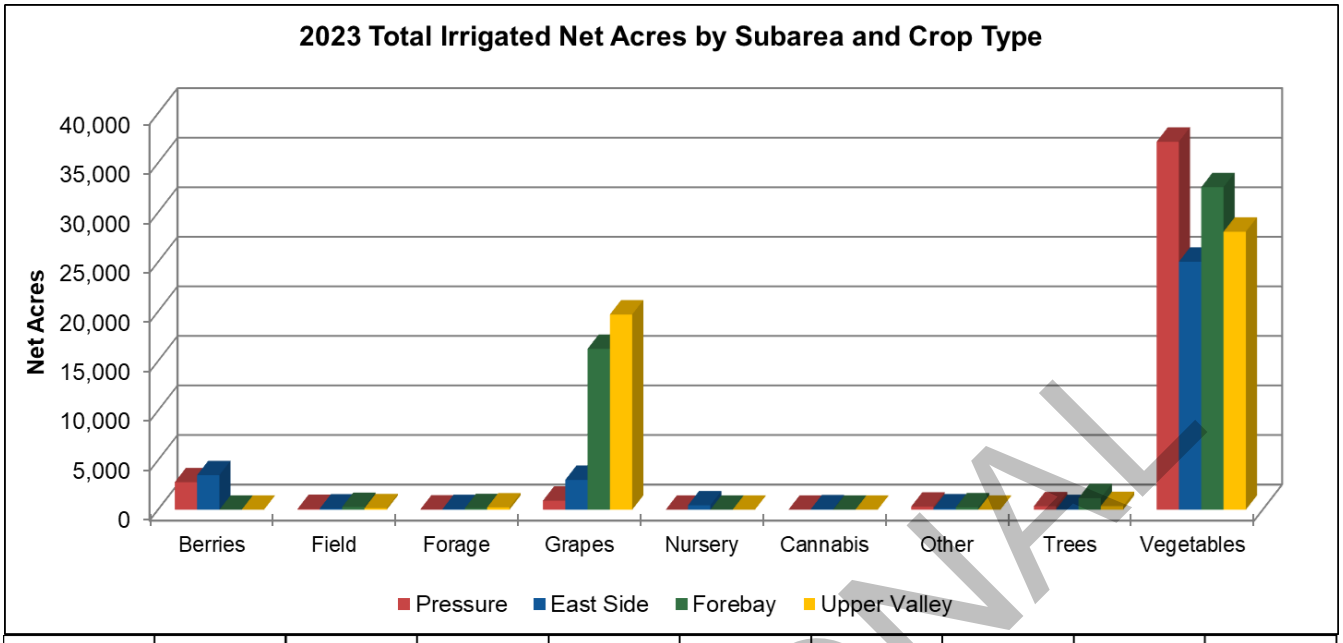
Changing weather patterns, variable soil types, and crop types affect the amount of water needed for efficient irrigation. Even during a normal rain year, pumping rates will vary from one subarea to another and crop types will vary depending on economic demand.

Examples of crop type categorizations include: strawberries and raspberries under Berries; beans and grains under Field Crops; alfalfa and pasture under Forage Crops; avocados and lemons under Tree Crops; and sod, flower bulbs, ornamentals, and cactus pears under Other Crops.



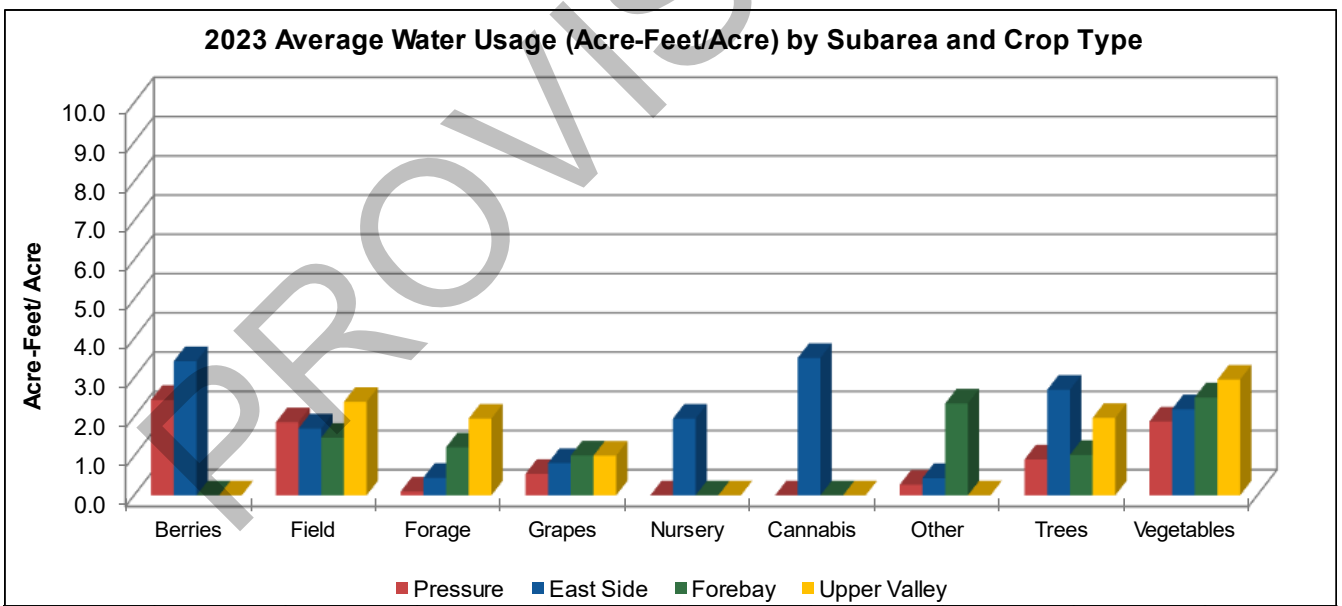
2023	Berries (AF)	Field (AF)	Forage (AF)	Grapes (AF)	Nursery (AF)	Cannabis (AF)	Other (AF)	Trees (AF)	Vegetables (AF)
Pressure	6,748	149	2.0	503	-	-	85.0	324	69,914
East Side	11,918	213	30.5	2,485	891	156	62.3	175	55,008
Forebay	-	401	197	16,517	-	-	560	1,211	81,287
Upper Valley	-	366	457	19,934	-	-	-	731	82,764

Figure 20. 2023 Extractions Reported by Crop Type and Subarea.



2023	Berries (Net Acres)	Field (Net Acres)	Forage (Net Acres)	Grapes (Net Acres)	Nursery (Net Acres)	Cannabis (Net Acres)	Other (Net Acres)	Trees (Net Acres)	Vegetables (Net Acres)
Pressure	2,774	80.0	20.8	918	-	-	310	353	37,142
East Side	3,486	125	67.9	3,011	446	44.5	142	65.0	25,031
Forebay	-	273	161	16,236	-	-	239	1,171	32,552
Upper Valley	-	153	233	19,706	-	-	-	370	28,057

Figure 21. 2023 Irrigated Net Acres Reported by Crop Type and Subarea.



2023	Berries (AF/Acre)	Field (AF/Acre)	Forage (AF/Acre)	Grapes (AF/Acre)	Nursery (AF/Acre)	Cannabis (AF/Acre)	Other (AF/Acre)	Trees (AF/Acre)	Vegetables (AF/Acre)
Pressure	2.4	1.9	0.1	0.5	-	-	0.3	0.9	1.9
East Side	3.4	1.7	0.4	0.8	2.0	3.5	0.4	2.7	2.2
Forebay	-	1.5	1.2	1.0	-	-	2.3	1.0	2.5
Upper Valley	-	2.4	2.0	1.0	-	-	-	2.0	2.9

Figure 22. 2023 Acre-Feet/Acre by Crop Type and Subarea.

Urban Water Conservation – Data Summary

Since 1996, the Agency has collected data on Urban Water Conservation Plans. Tables 10 and 11 show the top ten Best Management Practices (BMPs) for 2024 as a percentage of total acreage reported for “large” water systems (200 or more customer connections), and “small” water systems (between 15 and 199 customer connections). The reported water use per connection for different connection classes are summarized for small (Table 12, Figure 23) and large water systems (Table 13, Figure 24).

Table 10. Top Ten BMPs – Large Water Systems.

Top Ten BMPs Implemented for Large Water Systems	2024
Advise customers when it appears possible that leaks exist on customer's side of water meter	100%
Perform distribution system leak detection and repair whenever the audit reveals that it would be cost-effective	100%
Implement requirements that all new connections be metered and billed by volume of use	99%
Coordinate with other entities in regional efforts to promote water conservation practices	99%
Review proposed water uses for new commercial and industrial water service, and make recommendations for improving efficiency before completion of building permit process	97%
Complete an audit of water distribution system at least every three years as prescribed by American Water Works Association	97%
Enact and enforce measure prohibiting water waste as specified in Monterey County Water Resources Agency Ordinance No. 3932 or as subsequently amended, and encourage the efficient use of water	97%
Enforcement and support of water conserving plumbing fixture standards, including gradual requirement for High Efficiency Toilets (HET) in all new construction	96%
Provide conservation information in bill inserts	96%
Provide speakers to community groups and media	96%

Table 11. Top Ten BMPs – Small Water Systems.

Top Ten BMPs Implemented for Small Water Systems	2024
Advise customers when it appears possible that leaks exist on customer's side of water meter	99%
Implement requirements that all new connections be metered and billed by volume of use	97%
Establish a program to retrofit any existing unmetered connections and bill by volume of use	66%
Support of legislation prohibiting sale of toilets using more than 1.6 gpf	64%
Perform distribution system leak detection and repair whenever the audit reveals that it would be cost-effective	64%
Provide guidelines, information, and/or incentives for installation of more efficient landscapes and water saving practices	57%
Designate a water conservation coordinator responsible for preparing the water conservation plan, managing its implementation, and evaluating its results	56%
Provide individual historical water use information on water bills	55%
Encourage and promote the elimination of non-conserving pricing and adoption of conservation pricing policies	55%
Implementation of conservation pricing policy	53%

Table 12. Water Use per Connection – Small Water Systems (2019-2023).

Small Water Systems: Water Use (AF) Per Connection Class	2019	2020	2021	2022	2023
Single-Family Residential	0.429	0.429	0.423	0.454	0.300
Multi-Family Residential	0.763	0.738	0.600	0.998	0.234
Commercial/ Institutional	0.864	0.806	1.276	1.115	0.996
Industrial	46.986	37.142	52.108	43.073	35.402
Landscape Irrigation	3.559	6.565	2.369	1.832	0.741
Other	3.066	4.702	8.035	13.451	8.166

Figure 23. Urban Water Use per Connection – For Small Water Systems

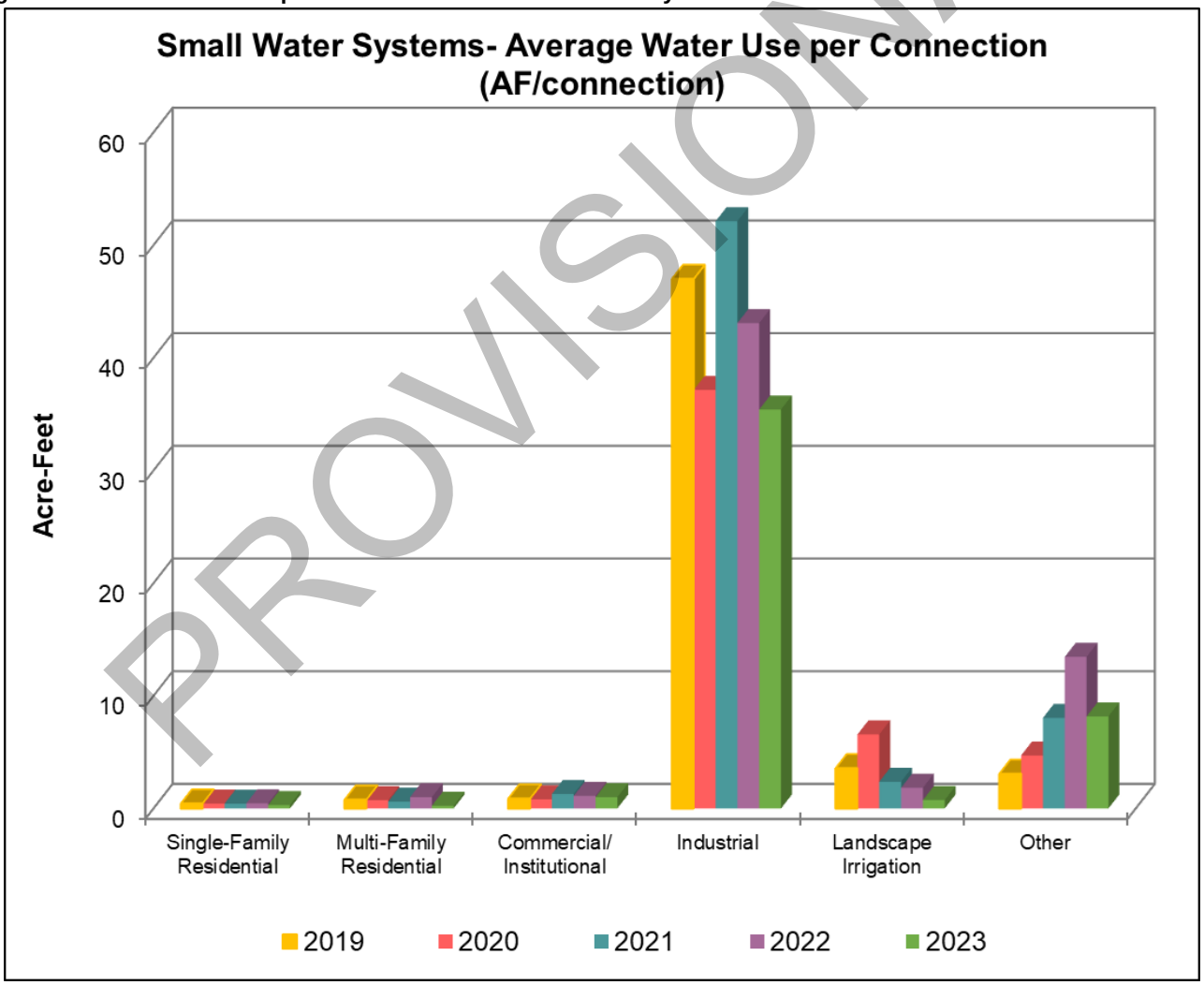
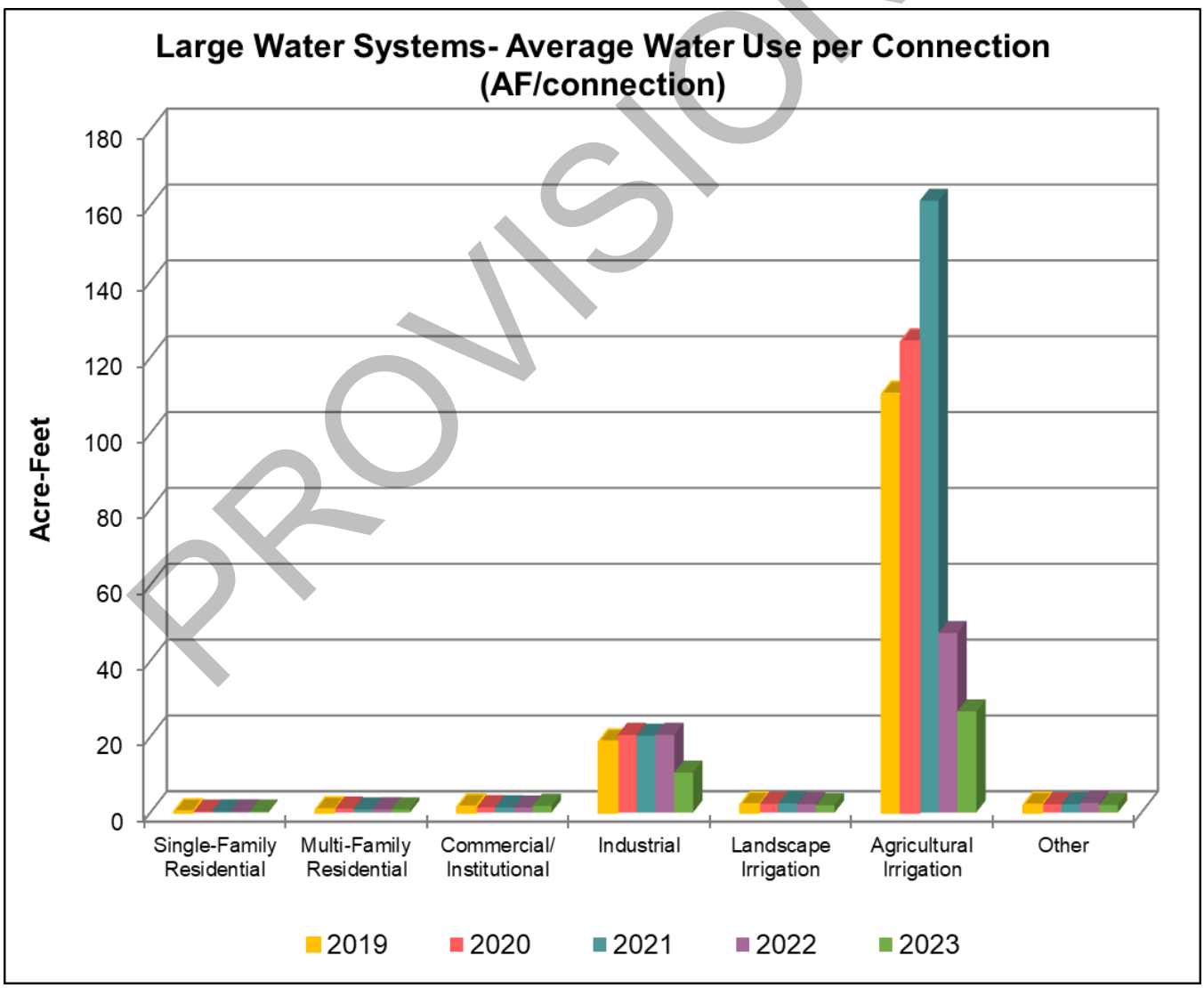


Table 13. Water Use per Connection – Large Water Systems (2019-2023).

Large Water Systems: Water Use (AF) Per Connection Class	2019	2020	2021	2022	2023
Single-Family Residential	0.277	0.273	0.282	0.281	0.262
Multi-Family Residential	0.827	1.032	0.836	0.873	0.815
Commercial/ Institutional	1.553	1.414	1.380	1.316	1.763
Industrial	18.712	20.480	20.227	20.472	10.501
Landscape Irrigation	2.133	2.318	2.433	2.245	1.926
Agricultural Irrigation	110.451	124.190	161.299	47.313	26.659
Other	2.034	2.191	2.176	2.553	2.021

Figure 24. Urban Water Use per Connection – For Large Water Systems



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Shaunna Murray, Deputy General Manager

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