2020

Groundwater Extraction Summary Report

Monterey County Water Resources Agency

July 2021


MONTEREY COUNTY WATER RESOURCES AGENCY
1947

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Overview of the Groundwater Reporting Program

History of the Groundwater 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 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 1991, the Agency has required the annual submittal of Agricultural Water Conservation Plans (Ordinance 3851), 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 of the agricultural water conservation plans, this program provides an overview of the BMPs to be implemented by urban water purveyors as conservation measures.

For management purposes, the Agency divides a portion of the Salinas Valley Groundwater Basin into four hydrologic subareas or zones; 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.

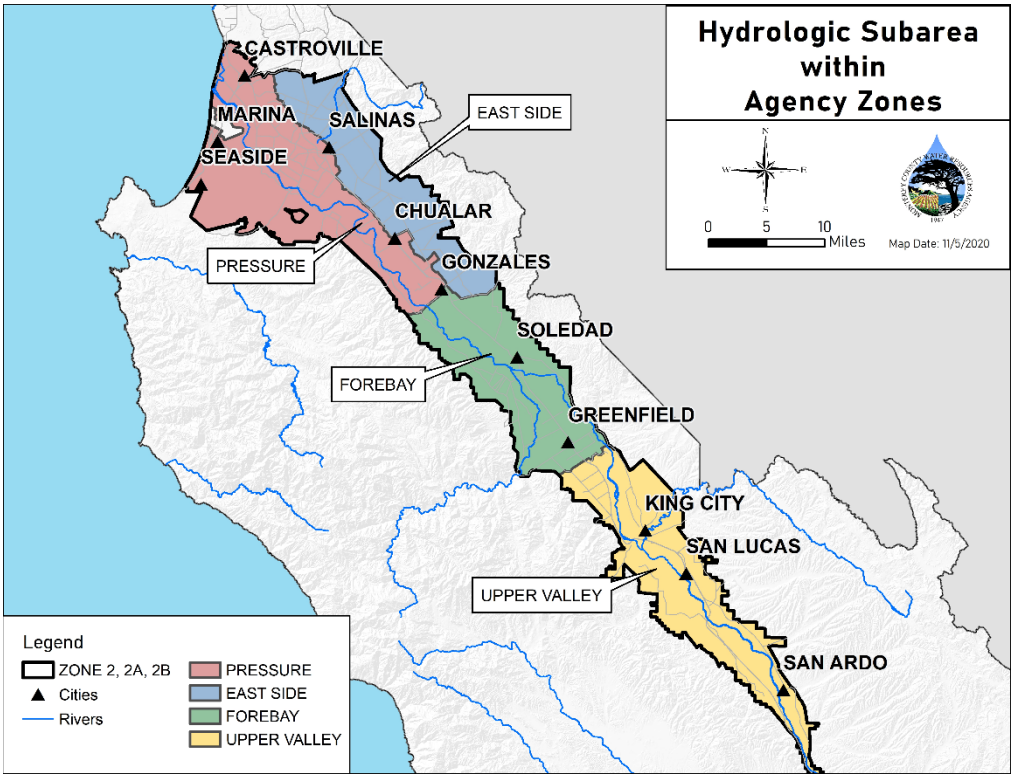
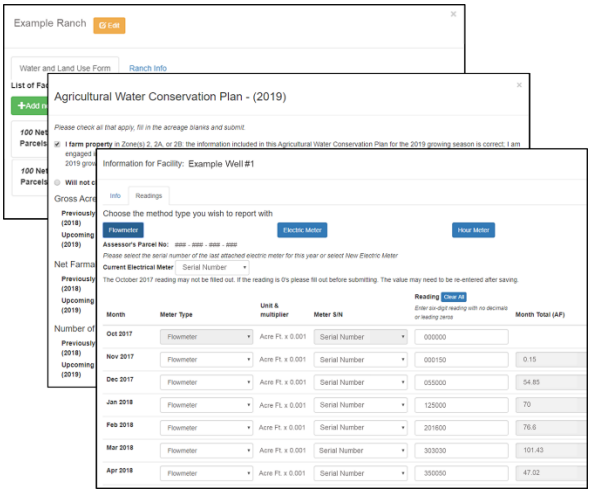


Figure 1. Hydrologic Subareas within Agency Zones 2, 2A, and 2B

Groundwater Summary Report

The purpose of this report is to summarize the data submitted to the Agency by well operators in February 2021 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, 2019, through October 31, 2020; the urban data covers calendar year 2020. The agricultural and urban water conservation plans for 2021 are also summarized. This report is intended to present a synopsis of current water 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 by measurement in 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 2020 reporting year was: 83% Flowmeter; 16% Electrical Meter and <1% Hour Meter.

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. The Agency received Groundwater Extraction Reports from ninety-nine percent (95%) of the 1,877 wells in Zones 2, 2A, and 2B of the Salinas Valley for the 2020 reporting year. Agricultural and Urban Water Conservation Plan submittal compliance for 2020 was eighty-three percent (83%) eighty-six percent (86%), respectively.

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	97,821	16,464	**114,285**
East Side	75,125	13,617	**88,742**
Forebay	124,643	7,590	**132,233**
Upper Valley	128,016	2,827	**130,843**
Total (AF)	**425,605**	**40,498**	**466,103**
Percent of Total	**91.3%**	**8.7%**	**100.0%**

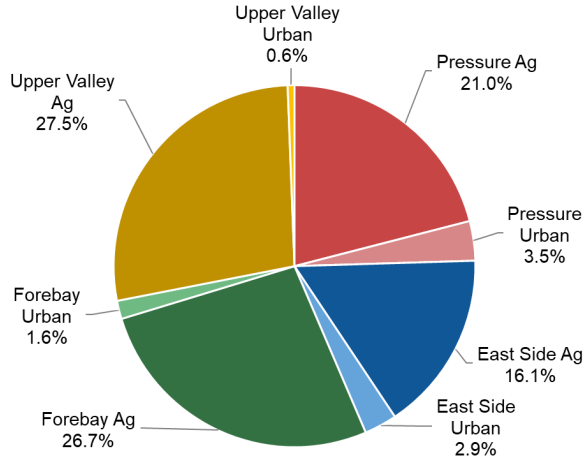


Figure 2. Percentage of Ag and Urban Extractions by Subarea.

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.

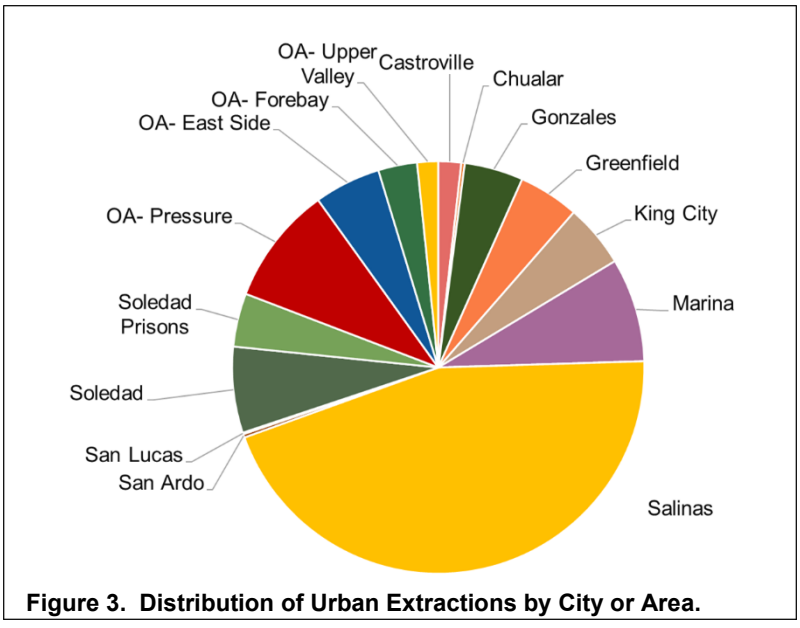


Figure 3. Distribution of Urban Extractions by City or Area.

Table 2. Urban Extractions by City or Area

City or Area	Urban Pumping (AF)	Percentage
Castroville	725	1.79%
Chualar	109	0.27%
Gonzales	1,868	4.61%
Greenfield	1,925	4.75%
King City	2,004	4.95%
Marina	3,296	8.14%
Salinas	18,214	44.97%
San Ardo	110	0.27%
San Lucas	48	0.12%
Soledad	2,735	6.75%
Soledad Prisons	1,695	4.19%
OA- Pressure	3,758	9.28%
OA- East Side	2,111	5.21%
OA- Forebay	1,235	3.05%
OA- Upper Valley	666	1.64%
Total	**40,499**	**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 2020 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 some wells being unknown.

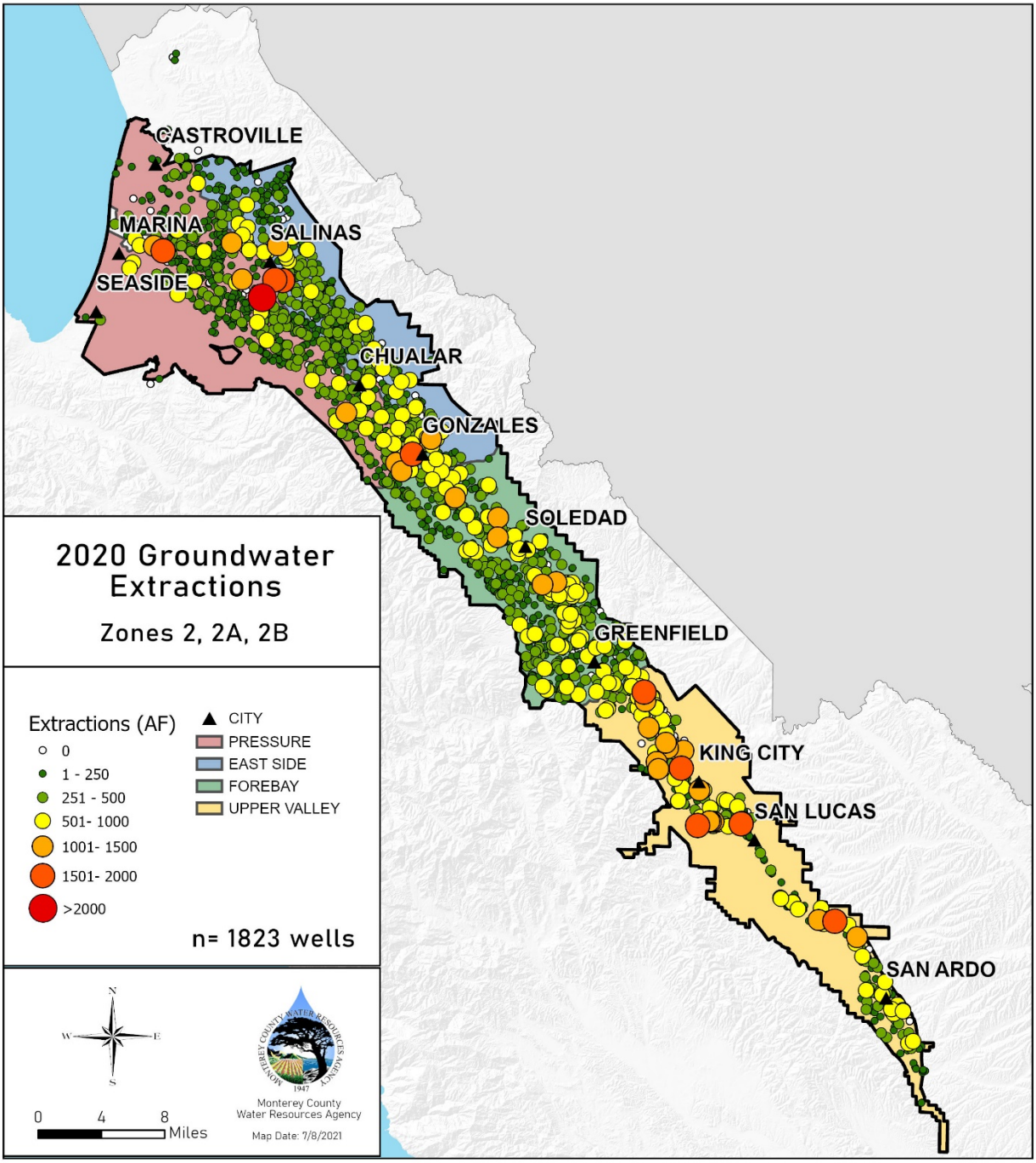


Figure 4. 2020 Groundwater Extractions (AF).

Pressure Subarea – Extraction Data

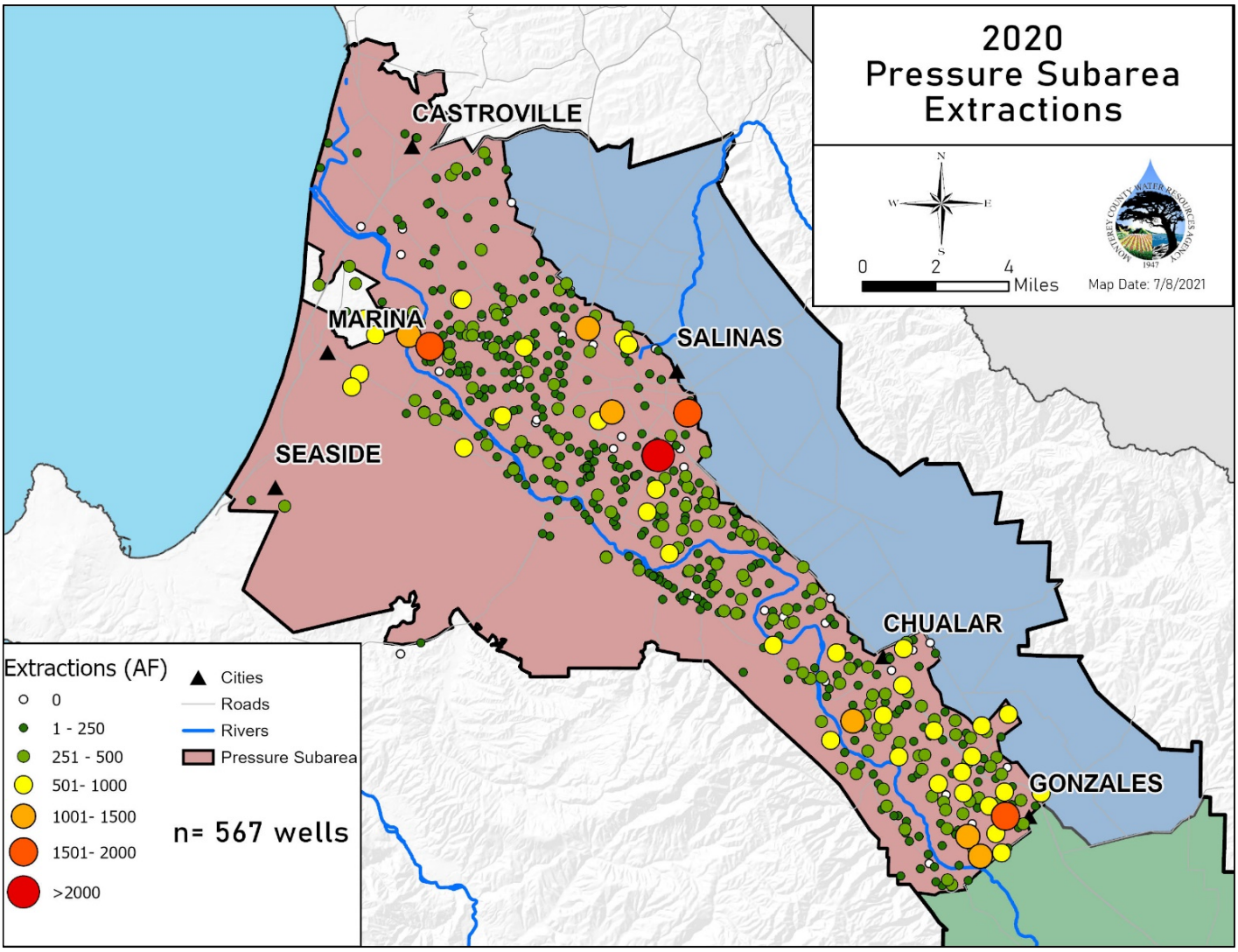


Figure 5. 2020 Groundwater Extractions in the Pressure Subarea.

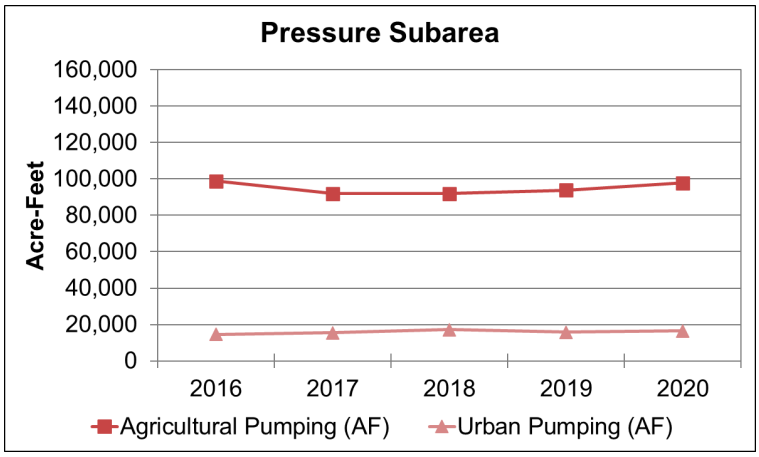


Figure 6. Agricultural and Urban Extractions (AF) in the Pressure Subarea 2016-2020.

Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2020	97,821	16,452	114,273
2019	93,829	15,885	109,714
2018	92,010	17,246	109,256
2017	91,901	15,523	107,424
2016	98,890	14,605	113,495

Table 3. Total, Agricultural, and Urban Extractions (AF) in the Pressure Subarea 2016-2020.

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

The Castroville Seawater Intrusion Project (CSIP) delivers recycled water from the Salinas Valley Reclamation Project, treated Salinas River water from the Salinas River Diversion Facility, and groundwater from ten supplemental wells to 12,000 acres of irrigated land in the Castroville area, referred to as Zone 2B, in an effort to reduce groundwater pumping near the coast. Pumping from non-CSIP supplemental 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).

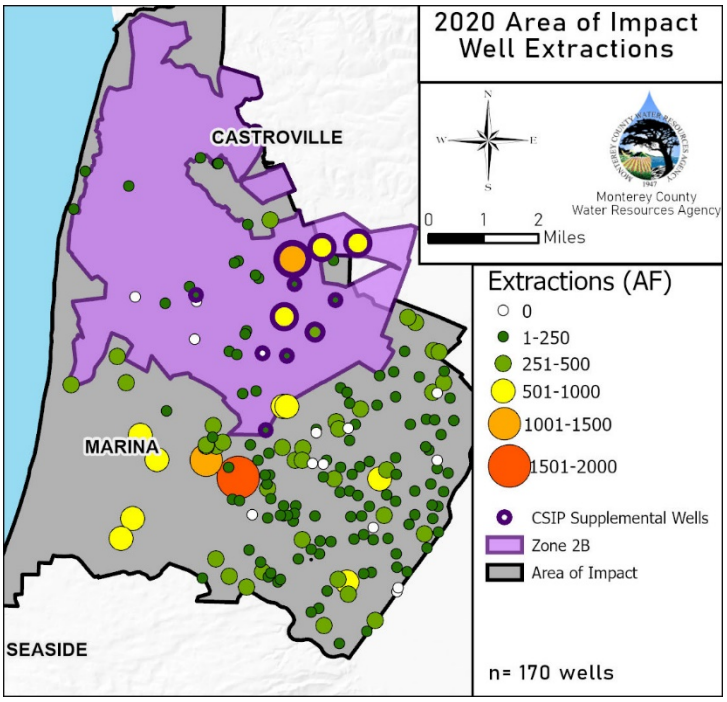


Figure 7. 2020 Groundwater Extractions (AF) in the Area of Impact.

Aquifer	Agriculture Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
180-Ft Aquifer or East Side Shallow	2,302	4	2,306
180 and 400-Ft Aquifer	998	300	1,298
400-Ft Aquifer or East Side Deep	12,418	1,277	13,695
Deep Aquifers	6,208	1,760	7,968
Unknown	3,022	0	3,022
Total (AF)	24,948	3,341	28,290

Table 4. 2020 Extraction Data in the Area of Impact by Aquifer and Type of Use

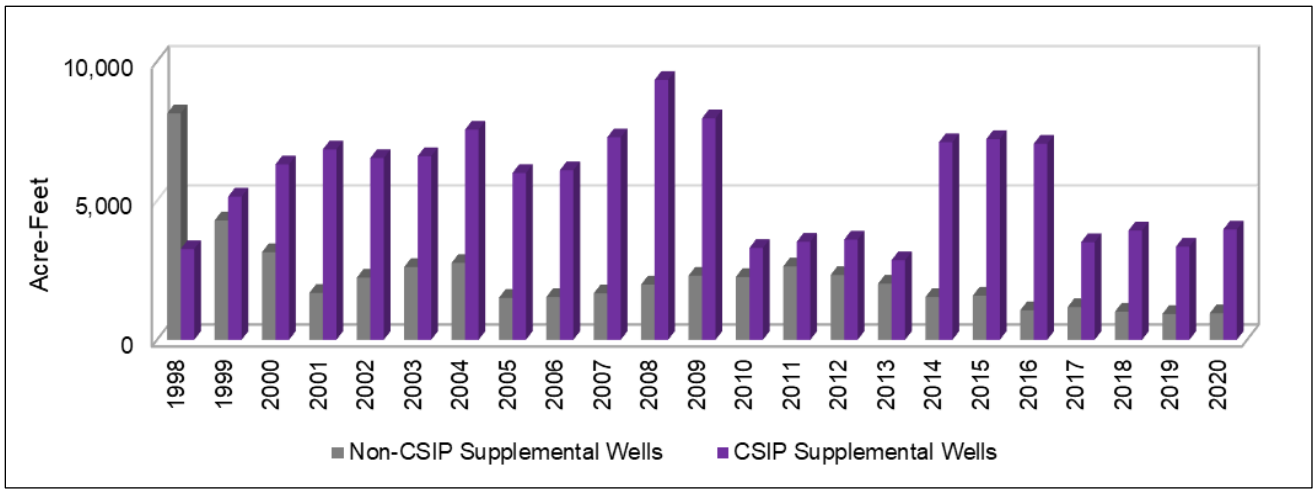


Figure 8. Groundwater Extractions in Zone 2B from CSIP and Non-CSIP Supplemental Wells, 1993-2020

Deep Aquifers – Extraction Data

The first production well in the Deep Aquifers was installed in 1974. As of December 2020, fifty-seven wells have been installed in the Deep Aquifers, with seventeen installed since 2017 (Figure 9). 9 of the 17 wells installed since 2017 have not yet reported any extractions as this reporting year. 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

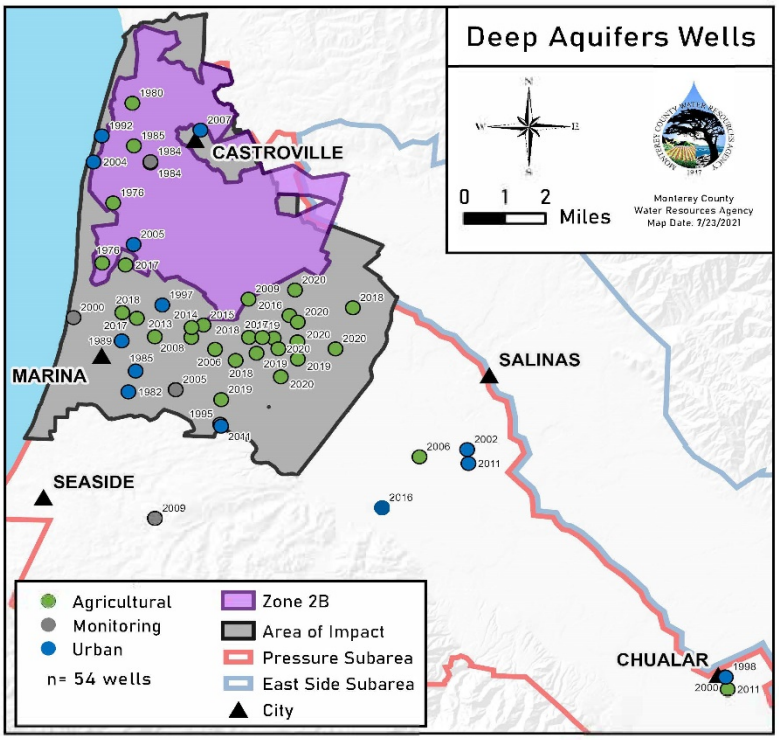


Figure 9. Deep Aquifers Wells by Year Drilled and Type of Use

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

Table 5. Deep Aquifers Groundwater Extractions by Type of Use, 1993-2020

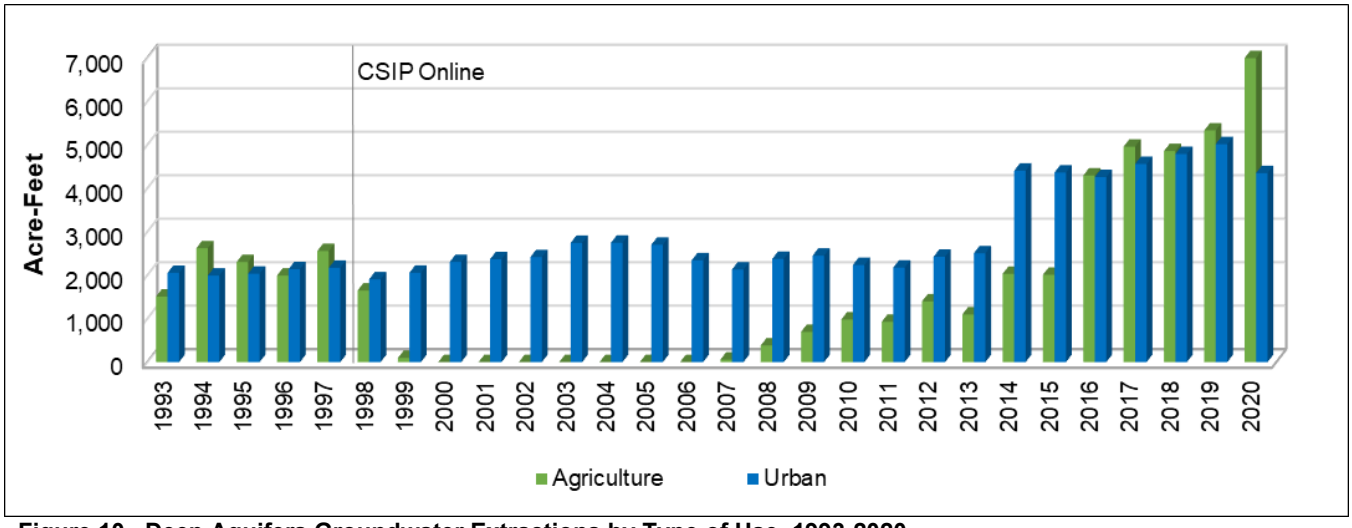


Figure 10. Deep Aquifers Groundwater Extractions by Type of Use, 1993-2020

East Side Subarea – Extraction Data

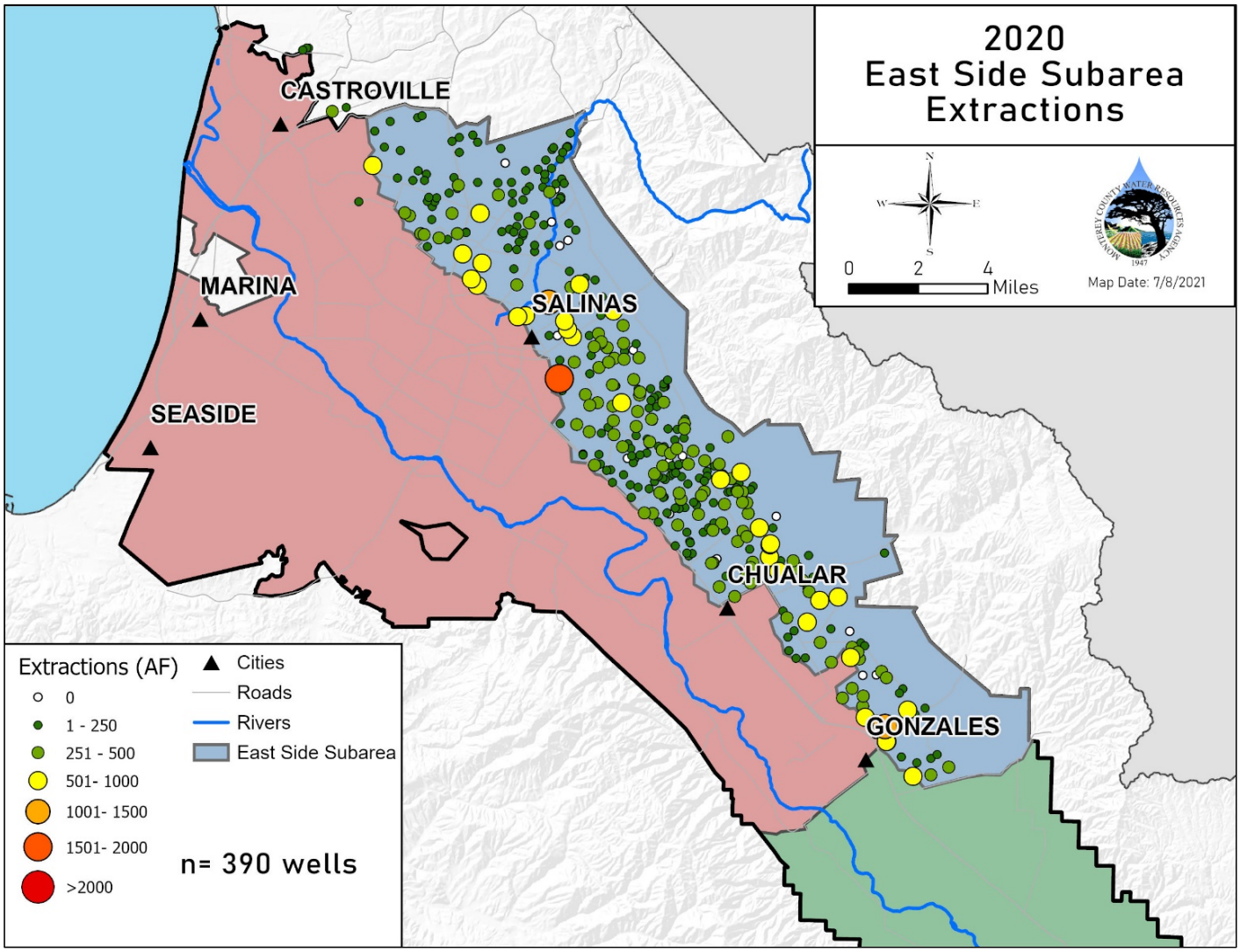


Figure 11. 2020 Groundwater Extractions in the East Side Subarea.

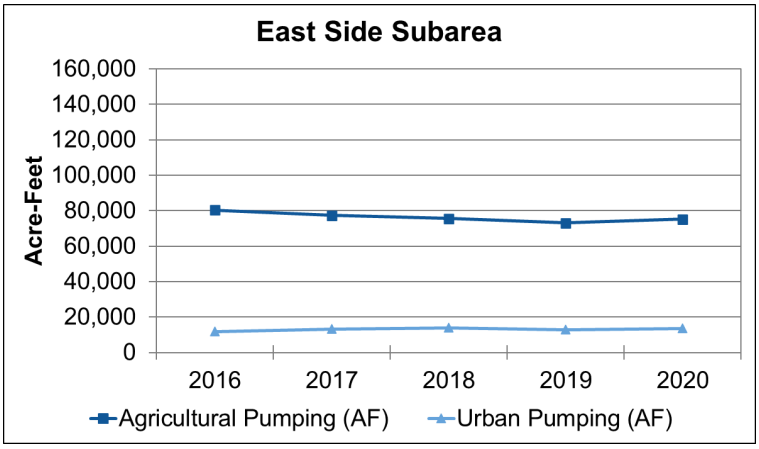


Figure 12. Agricultural and Urban Extractions (AF) in the East Side Subarea 2016-2020.

Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2020	75,125	13,617	88,742
2019	73,006	12,822	85,828
2018	75,629	13,938	89,567
2017	77,353	13,258	90,611
2016	80,379	11,802	92,181

Table 6. Total, Agricultural, and Urban Extractions (AF) in the East Side Subarea 2016-2020.

Forebay Subarea – Extraction Data

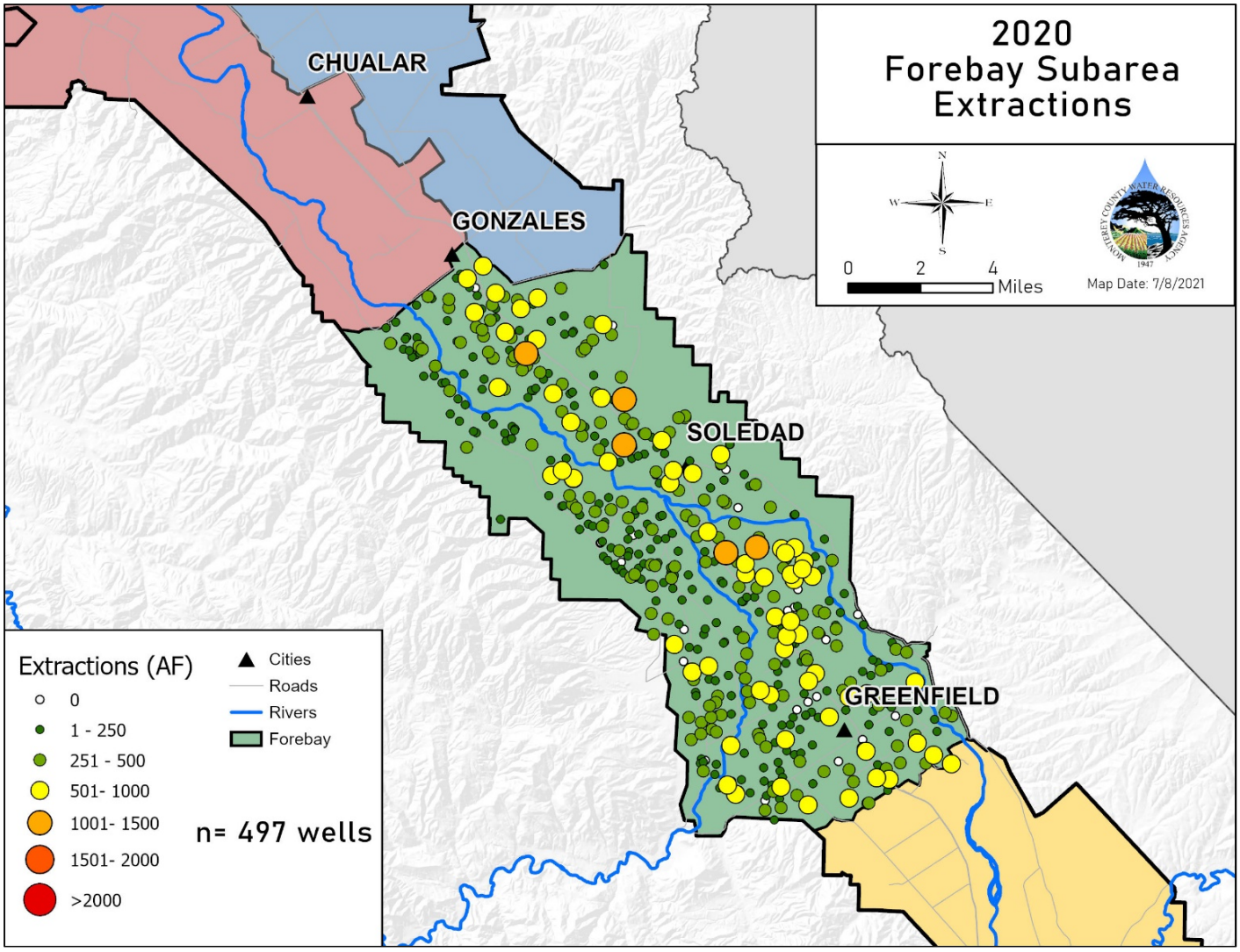


Figure 13. 2020 Groundwater Extractions in the Forebay Subarea.

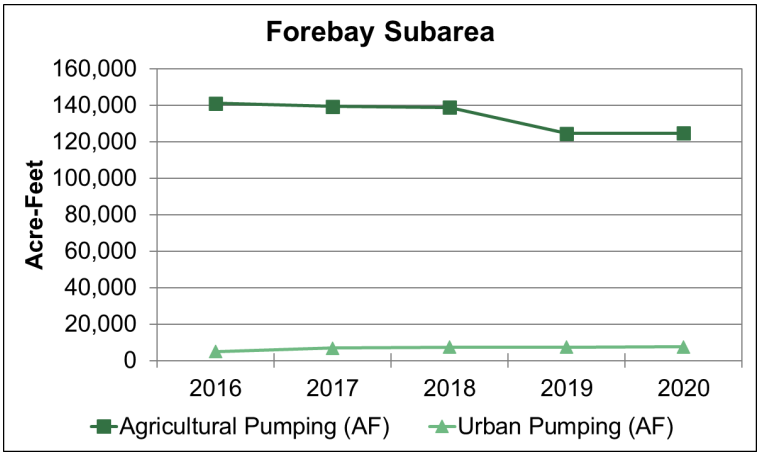


Figure 14. Agricultural and Urban Extractions (AF) in the Forebay Subarea 2016-2020.

Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2020	124,643	7,590	132,233
2019	124,600	7,374	131,974
2018	138,838	7,303	146,141
2017	139,359	6,764	146,123
2016	141,163	4,866	146,029

Table 7. Total, Agricultural, and Urban Extractions (AF) in the Forebay Subarea 2016-2020.

Upper Valley Subarea – Extraction Data

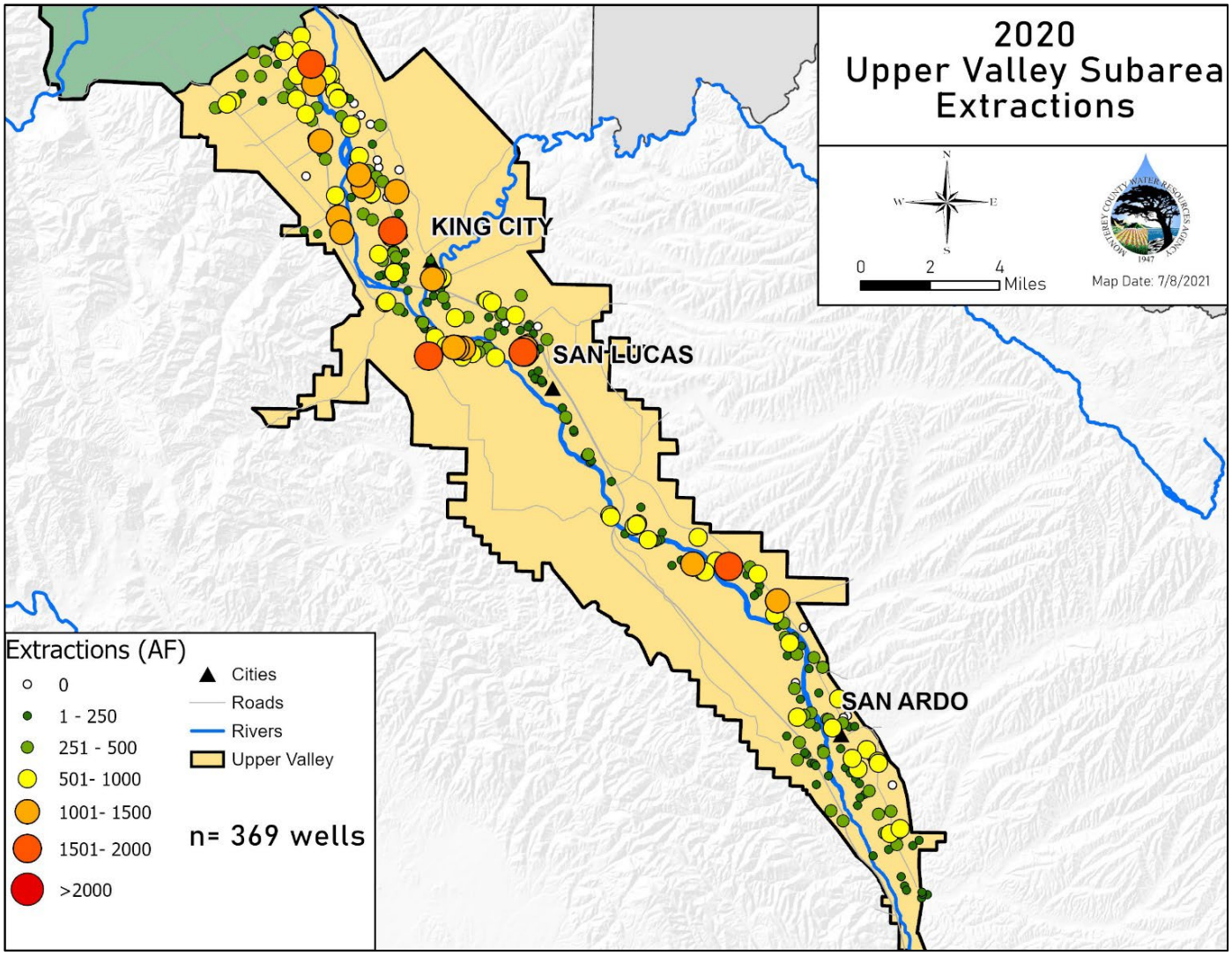


Figure 15. 2020 Groundwater Extractions in the Upper Valley Subarea

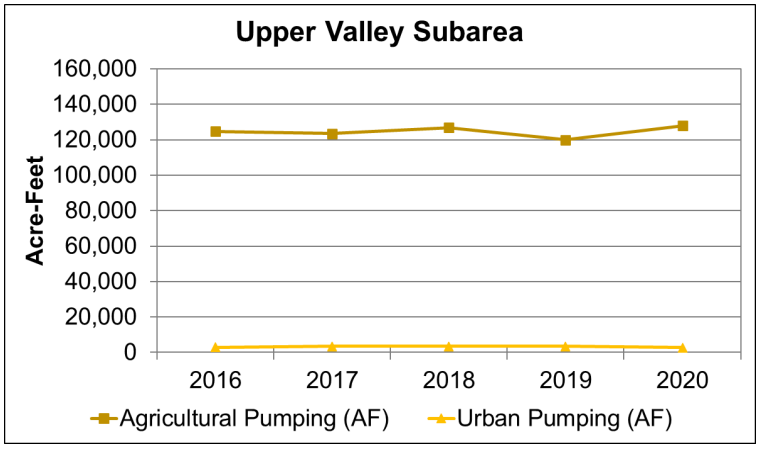


Figure 16. Agricultural and Urban Extractions (AF) in the Upper Valley Subarea 2016-2020.

Year	Agricultural Pumping (AF)	Urban Pumping (AF)	Total Pumping (AF)
2020	128,016	2,827	130,844
2019	120,025	3,430	122,907
2018	126,919	3,418	130,337
2017	123,446	3,407	126,853
2016	124,678	2,991	127,669

Table 8. Total, Agricultural, and Urban Extractions (AF) in the Upper Valley Subarea 2016-2020.

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 2021.

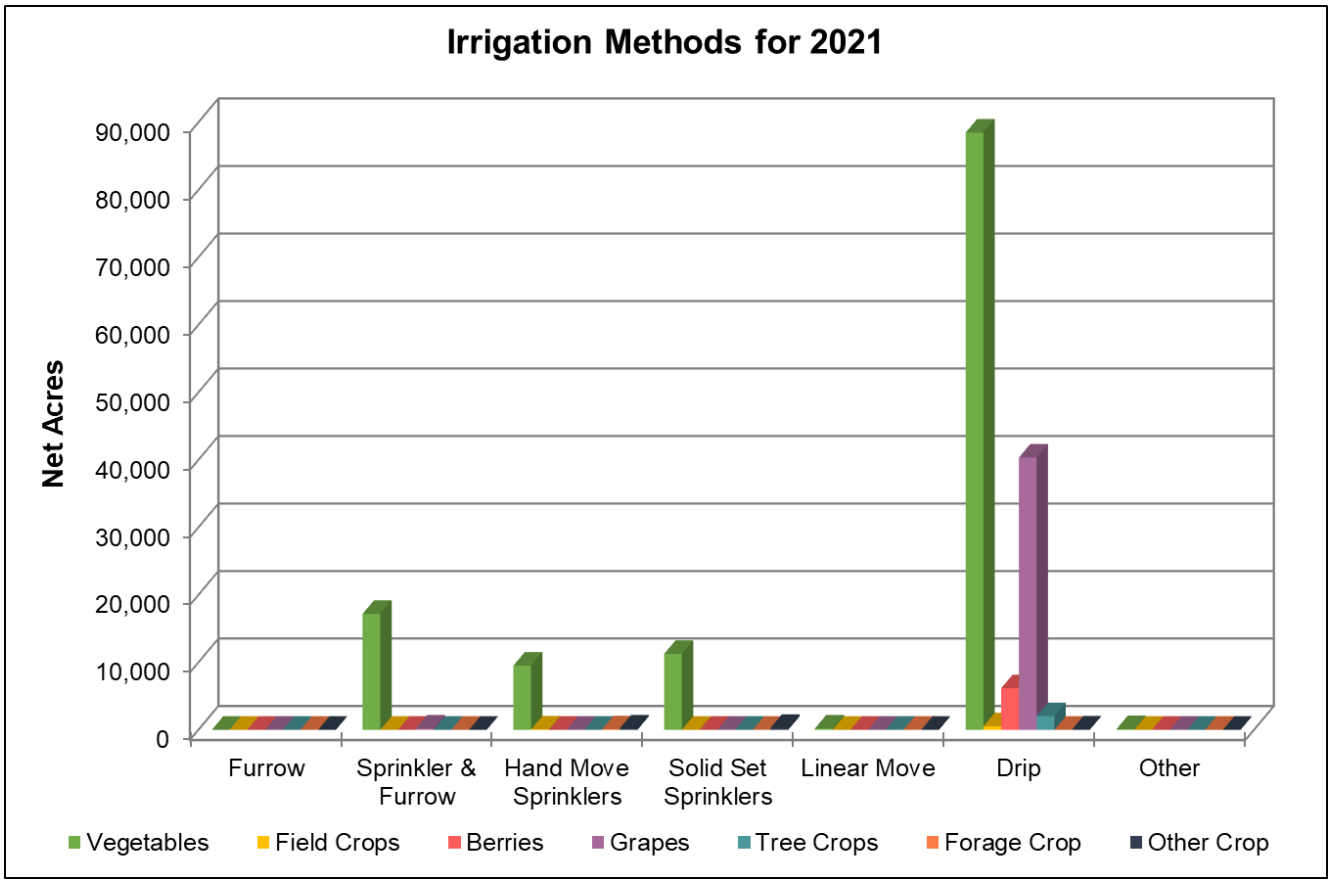


Figure 17. 2021 Forecasted Net Acre Distribution of Irrigation Methods by Crop Type.

2021	Furrow	Sprinkler & Furrow	Hand Move Sprinklers	Solid Set Sprinklers	Linear Move	Drip	Other	Total
Vegetables	0	17,366	9,499	11,242	194	88,477	102	126,880
Field Crops	0	0	54	0	0	514	0	567
Berries	0	0	0	0	0	6,149	0	6,149
Grapes	0	0	0	0	0	40,327	0	40,327
Tree Crops	0	0	0	0	0	2,020	0	2,020
Forage Crop	0	0	61	3	15	0	0	79
Other Crop	0	0	198	288	0	46	0	532
Unirrigated								1,705
Total	**0**	**17,366**	**9,812**	**11,533**	**209**	**137,533**	**102**	**178,260**

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

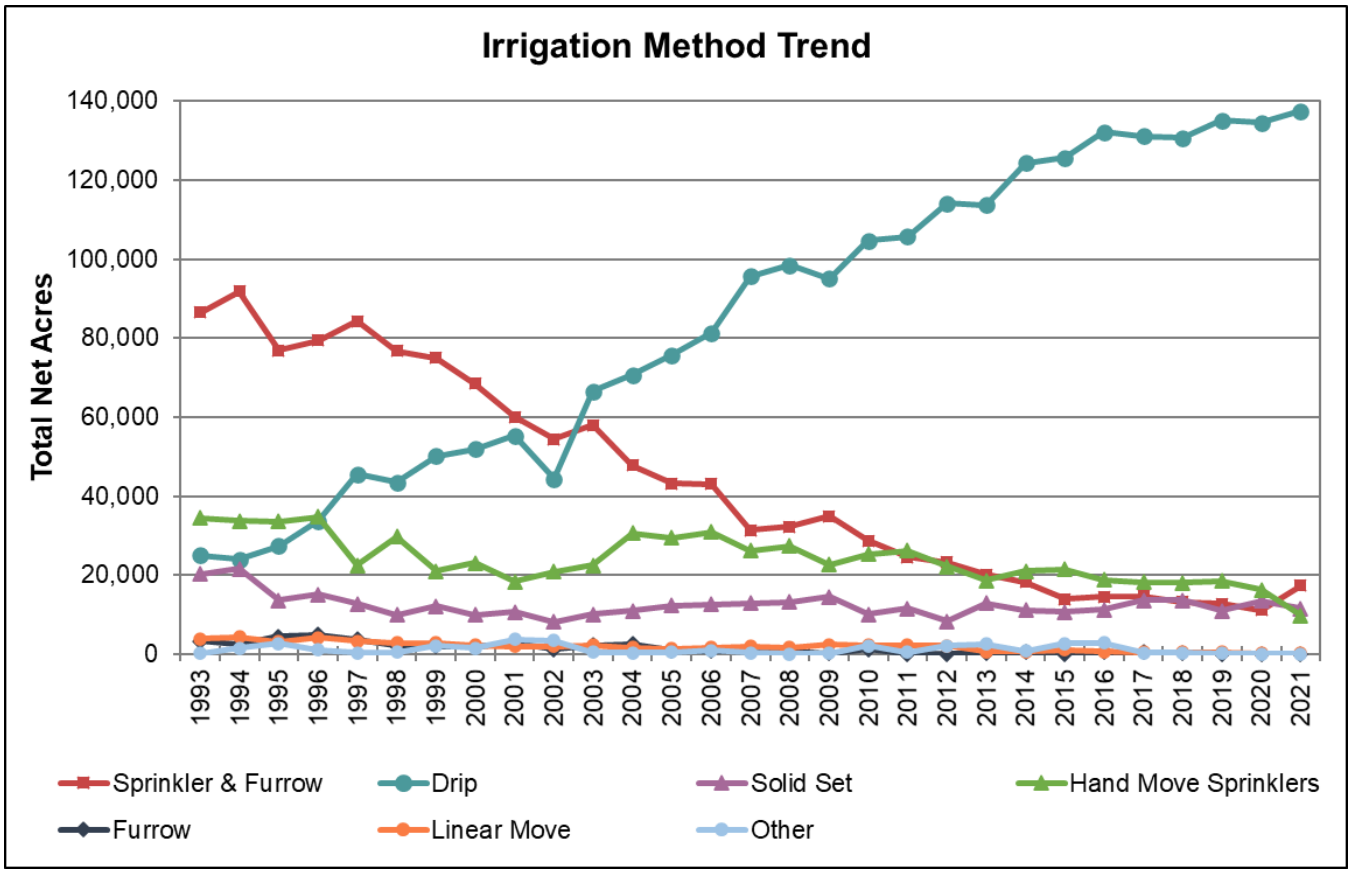


Figure 18. Changes in Irrigation Methods Used Over Time (1993 – 2021) in Zones 2, 2A, and 2B.

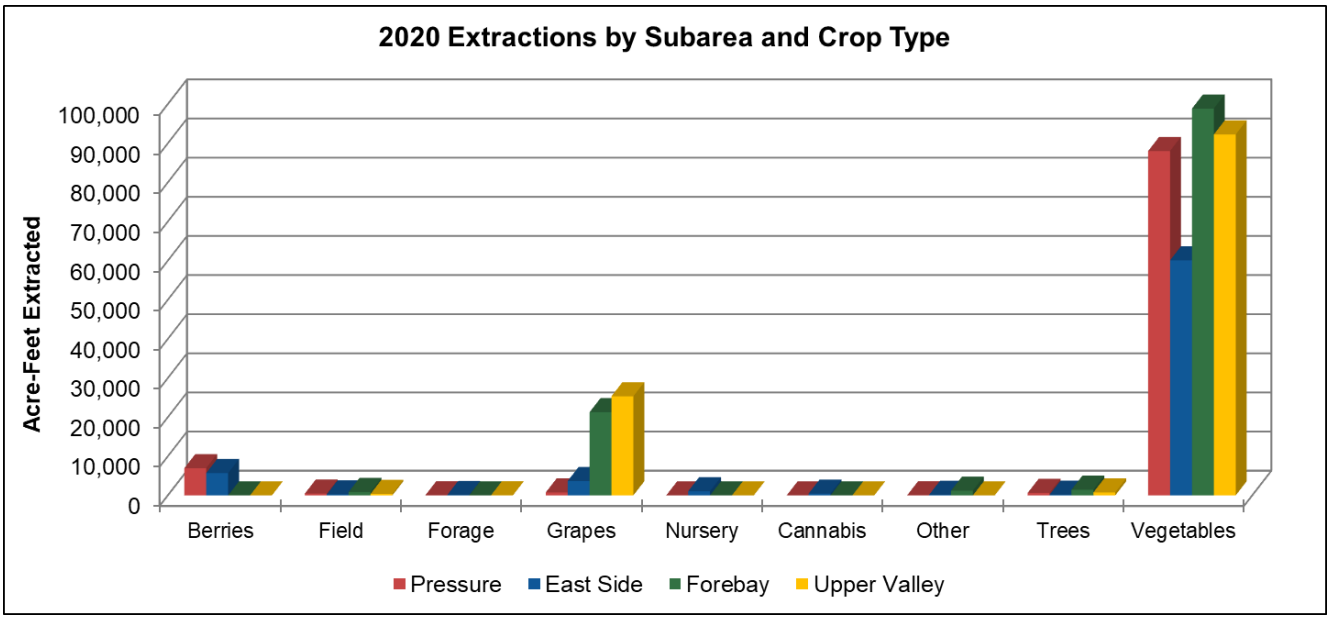
Figure 19. Top Ten BMPs Forecasted for 2021 Based on Reported Net Acres.

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.

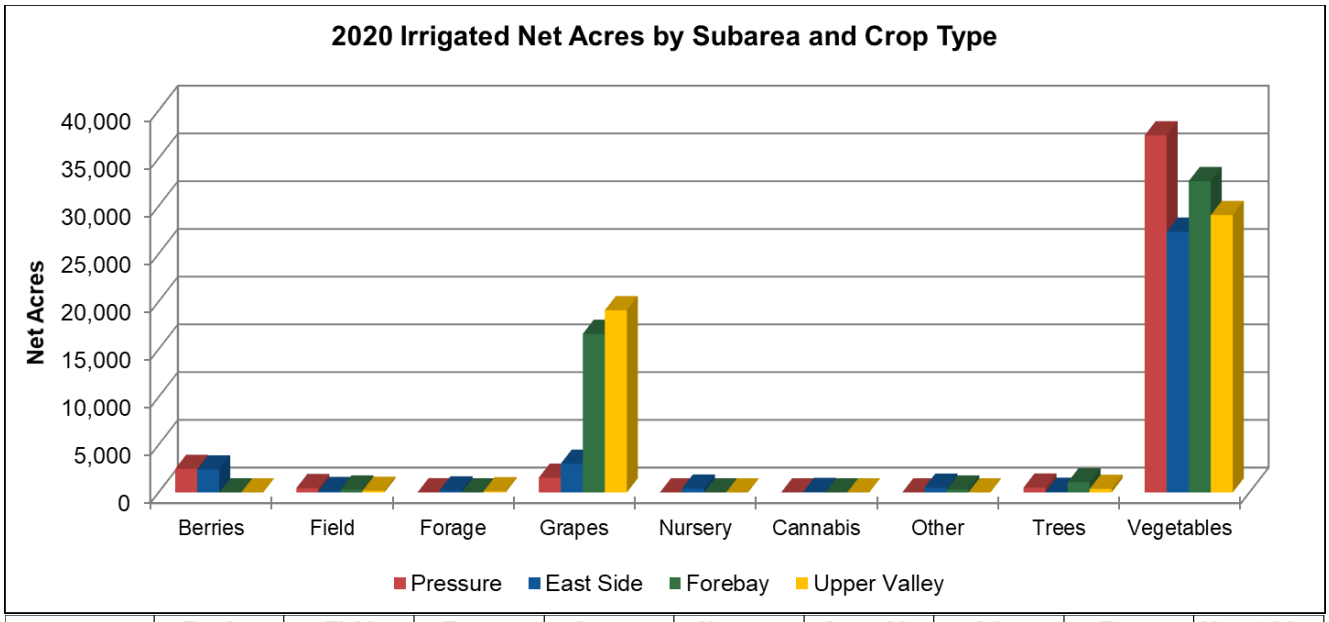
Changing weather patterns, variable soil types, and crop types affect the amount of water needed for efficient irrigation. Even during a normal rain year, pumping rates will vary from one subarea to another and crop types will vary depending on economic demand.

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.



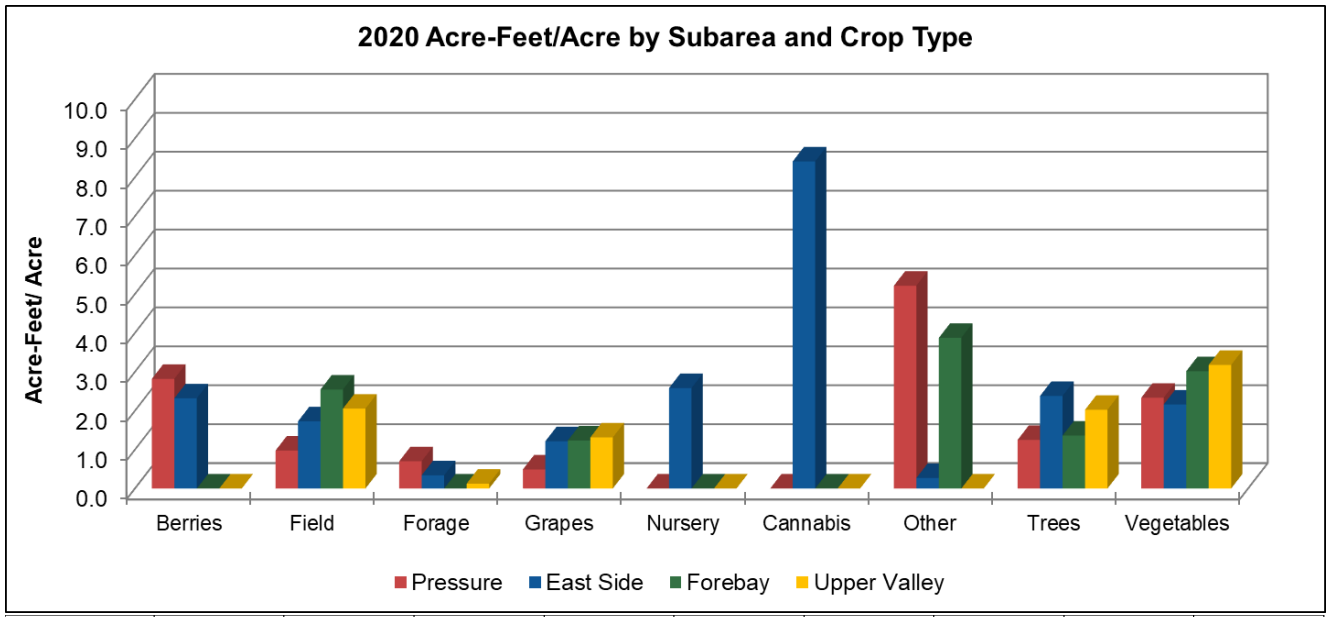
2020	Berries (AF)	Field (AF)	Forage (AF)	Grapes (AF)	Nursery (AF)	Cannabis (AF)	Other (AF)	Trees (AF)	Vegetables (AF)
Pressure	6,945	445	7.0	753	-	-	26.1	628	88,006
East Side	5,693	241	69.0	3,655	1,042	439	134	155	60,051
Forebay	-	863	-	21,258	-	-	1,179	1,440	98,849
Upper Valley	-	360	15.6	25,319	-	-	-	748	92,240

Figure 20. 2020 Extractions Reported by Crop Type and Subarea.



2020	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	2,465	456	10.0	1,540	-	-	5.0	503	37,405
East Side	2,402	140	204	3,009	404	52.2	497	65.0	27,309
Forebay	-	306	-	16,616	-	-	305	1,059	32,613
Upper Valley	-	176	125	19,087	-	-	-	370	29,053

Figure 21. 2020 Irrigated Net Acres Reported by Crop Type and Subarea.



2020	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	2.8	1.0	0.7	0.5	-	-	5.2	1.2	2.3
East Side	2.3	1.7	0.3	1.2	2.6	8.4	0.3	2.4	2.2
Forebay	-	2.5	-	1.2	-	-	3.9	1.4	3.0
Upper Valley	-	2.1	0.1	1.3	-	-	-	2.0	3.2

Figure 22. 2020 Acre-Feet/Acre by Crop Type and Subarea.

Urban Water Conservation – Data Summary

Since 1996, the Agency has collected data on the Urban Water Conservation Plan program. Tables 10 and 11 show the top ten Best Management Practices (BMPs) for 2021, 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 then summarized for large (Table 12, Figure 23) and small water systems (Table 13, Figure 24).

Table 10. Top Ten BMPs – Large Water Systems.

Top Ten BMPs Implemented for Large Water Systems	2021
Advise customers when it appears possible that leaks exist on customer's side of water meter	100%
Complete an audit of water distribution system at least every three years as prescribed by American Water Works Association	100%
Establish a program to retrofit any existing unmetered connections and bill by volume of use	100%
Implement requirements that all new connections be metered and billed by volume of use	100%
Provide conservation information in bill inserts	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	96%
Perform distribution system leak detection and repair whenever the audit reveals that it would be cost-effective	95%
Enforcement and support of water conserving plumbing fixture standards, including gradual requirement for High Efficiency Toilets (HET) in all new construction	94%
Coordinate with other entities in regional efforts to promote water conservation practices	92%
Provide conservation training, information, and incentives necessary to encourage use of conservation practices	92%

Table 11. Top Ten BMPs – Small Water Systems.

Top Ten BMPs Implemented for Small Water Systems	2021
Advise customers when it appears possible that leaks exist on customer's side of water meter	77%
Perform distribution system leak detection and repair whenever the audit reveals that it would be cost-effective	76%
Implement requirements that all new connections be metered and billed by volume of use	74%
Establish a program to retrofit any existing unmetered connections and bill by volume of use	73%
Implementation of conservation pricing policy	73%
Support of legislation prohibiting sale of toilets using more than 1.6 gpf	69%
Provide guidelines, information, and/or incentives for installation of more efficient landscapes and water saving practices	52%
Complete an audit of water distribution system at least every three years as prescribed by American Water Works Association	45%
Encourage and promote the elimination of non-conserving pricing and adoption of conservation pricing policies	43%
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	29%

Table 12. Water Use per Connection – Small Water Systems (2016-2020).

Small Water Systems: Water Use (AF) Per Connection Class	2016	2017	2018	2019	2020
Single-Family Residential	0.426	0.516	0.411	0.429	0.429
Multi-Family Residential	0.640	0.689	0.567	0.763	0.738
Commercial/ Institutional	0.709	0.940	0.769	0.864	0.806
Industrial	54.826	54.437	52.240	46.986	37.142
Landscape Irrigation	1.100	1.934	3.220	3.559	6.565
Other	0.454	1.098	2.819	3.066	3.920

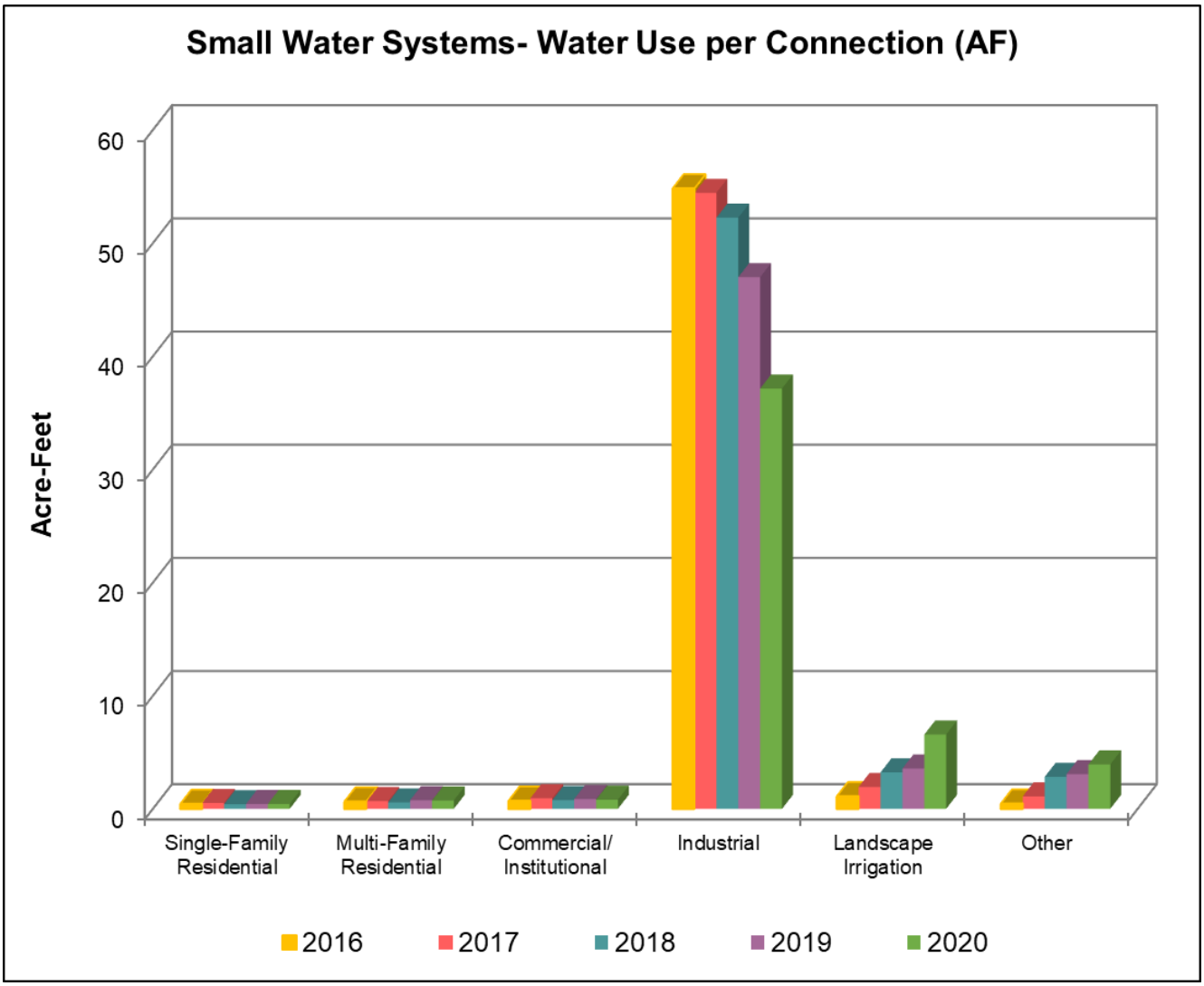


Figure 23. Urban Water Use per Connection – For Small Water Systems

Table 13. Water Use per Connection – Large Water Systems (2016-2020).

Large Water Systems: Water Use (AF) Per Connection Class	2016	2017	2018	2019	2020
Single-Family Residential	0.274	0.292	0.282	0.277	0.273
Multi-Family Residential	0.858	1.026	0.892	0.827	1.032
Commercial/ Institutional	1.579	1.583	1.635	1.553	1.414
Industrial	15.491	15.718	19.879	18.712	20.480
Landscape Irrigation	1.195	2.138	2.157	2.133	2.318
Agricultural Irrigation	38.649	21.223	87.650	110.451	124.190
Other	1.918	0.934	2.382	2.034	2.191

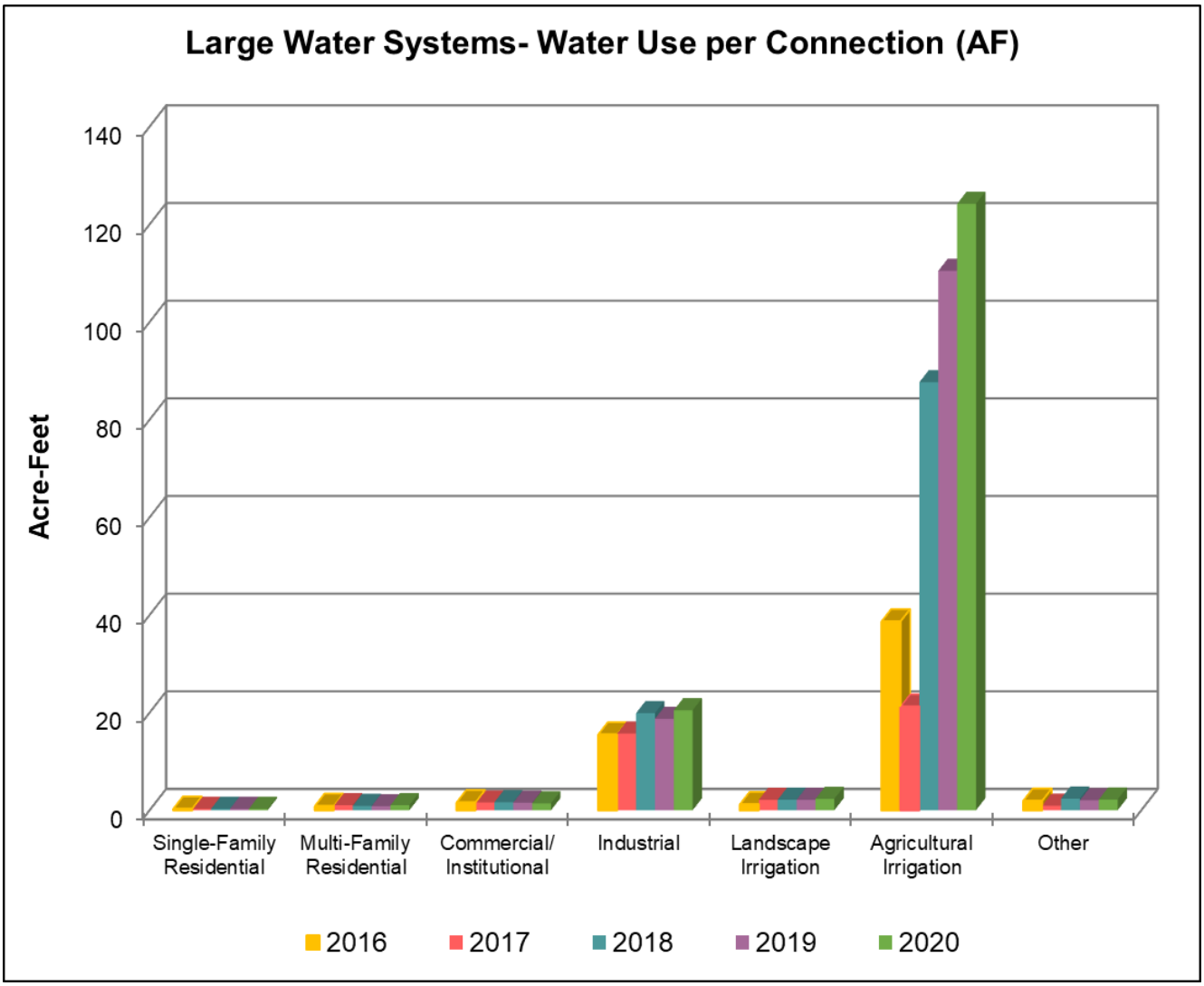


Figure 24. Urban Water Use per Connection – For Large Water Systems

Monterey County
Board of Supervisors

Luis Alejo	District #1
John M. Phillips	District #2
Chris Lopez	District #3
Wendy Root Askew, Chair	District #4
Mary Adams, Vice- Chair	District #5

Monterey County Water Resources Agency
Board of Directors

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Mike Scattini	District #2
Marvin Borizini	District #3
Deidre Sullivan	District #4
Ken Ekelund	District #5
Matt Simis	Grower-Shipper Association
Jason Smith	Monterey County Farm Bureau
John Baillie, Chair	Agricultural Advisory Committee
Mike LeBarre, Vice-Chair	City Select Committee

Monterey County Water Resources Agency

Brent Buche, General Manager
Elizabeth Krafft, Deputy General Manager

Groundwater Extraction Summary Report Team

Howard Franklin, Senior Hydrologist
Tamara Voss, Associate Hydrologist
Nicole Koerth, Water Resources Hydrologist
April Woods, Water Resources Technician

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