Appendix 2-B:

WRIA 18 Water Rights Analysis (Ecology 2000)

APPENDIX 2-B
WRIA 18 WATER RIGHTS ANALYSIS (ECOLOGY 2000)

Scope of Report and General Watershed Description

This report documents the status of groundwater and surface water applications, permits, certificates, and claims in the Elwha/Dungeness Water Resource Inventory Area (WRIA) 18. Readily available information about water rights and claims was used for this report. Field surveys or data collection was not conducted and, as such, data sources were not exhaustively checked for accuracy.

The Elwha/Dungeness Water Resource Inventory Area (WRIA 18) lies within the eastern portions of Clallam and Jefferson Counties, located on the Olympic Peninsula, approximately 50 miles inland from the Pacific Ocean. WRIA 18 is bounded by the Strait of Juan de Fuca to the north, the Soleduck River and Hoh River watersheds (WRIA 20) to the west, the Queets River and Quinault River watersheds (WRIA 21) to the southwest, the Dosewallips River watershed to the southeast (part of WRIA 16), and the Big and Little Quilcene River watersheds (part of WRIA 17) to the east (Figure 1).

Quantities for Groundwater and Surface Water Certificates and Permits

Information about pending groundwater and surface water certificates and permits was compiled from written records, the Water Rights Applications Tracking System (WRATS) database, and the Water Rights Information System (WRIS) database.

To evaluate the purpose of use and amount of water allocated within the study area, the authorized instantaneous (Qi) and annual (Qa) quantities were sorted by purpose of use and totaled for both groundwater (Table 1) and surface water (Table 2). Instantaneous and annual quantities are also depicted by percentage of purpose of use for both groundwater (Figures 2 and 3, respectively)[1] and surface water (Figures 4 and 5, respectively) [1]. Multiple purposes of use are often associated with a single instantaneous and annual quantity, and for those records the listed quantity was divided among and estimated for each purpose[2]. This process was also applied to records with missing data, which list a single purpose of use but lack an instantaneous or annual quantity. Water rights issued for "supplemental use" were aggregated by purpose and subtracted from the gross total, as those quantities are not additive[3].

The amount of groundwater diverted has increased steadily over time to a total withdrawal rate of 41,089 gpm (Figure 6) and 33,190 ac-ft/year. Similarly, surface water withdrawals have steadily increased and now total 1,659 cfs (Figure 7) and 70,248 ac-ft/year. As counted in acre-feet per year, over twice as much surface water as groundwater is authorized for use under water right certificates and permits (Tables 1 and 2).

[1]Indicated values represent the "Gross Total Minus Supplemental Use" as a percentage of the total allocated instantaneous or annual withdrawal rates listed in Tables 1, 2, and 3.

[2]Records with missing data or multiple purposes of use associated with a single instantaneous or annual quantity were assessed as follows:

a) Divided, or estimated (for records with missing data), use proportionately among listed purpose(s) by using values for estimating claims
b) Looked at the actual "paper" documentation for "odd" records and those associated with domestic multiple (DM) and municipal (MU) use
c) As necessary, consulted permit writers and "PRO-1070" (Water Resources Program Procedure for Water Quantity Allocation); For example, the Qi and Qa for group domestic use was eliminated and amounts were allocated to the remaining purpose(s) for a number of Adjudicated certificates issued to irrigation companies (specifically: S2-17220, S2-17224, S2-17238, S2-17239, S2-17237, S2-17236, S2-17235, S2-17234, S2-17232, S2-17221)

[3]Assessing "Supplemental Use" records:

Water right quantities issued for "supplemental use" represent a conservative estimation because totals include only information contained within the WRATS (Water Right Application Tracking System) database, and files may contain additional "supplemental use" allotments that were not tracked in WRATS. "Supplemental" rights are issued as an administrative tool to provide flexibility within a given project or water system, and are not additive. Similar limitations exist for water rights with quantities issued for "seasonal" or "emergency" use.

Quantities for Groundwater and Surface Water Applications

Information about pending groundwater and surface water applications was compiled from written records and the Water Rights Applications Tracking System (WRATS) database.

To evaluate applications for new water rights, the requested instantaneous (Qi) and annual (Qa) quantities were sorted by purpose of use and totaled for both groundwater (Table 3) and surface water (Table 4)[4]. For records with multiple purposes of use associated with a single instantaneous and annual quantity, the listed amount was divided among and estimated for each purpose[2]. Requests for "supplemental use" were aggregated by purpose and subtracted from the gross total, as those quantities are not additive[3].

As of September 7, 1999, 39 groundwater applications are on file, requesting a total withdrawal rate of 7,879 gpm and 10,195 ac-ft/year. As of the same date, 28 surface water applications are on file, requesting a total of 234 cfs and 4,618 ac-ft/yr. Instantaneous and annual quantities are also depicted by percentage of purpose of use for both groundwater (Figures 8 and 9, respectively)[1] and surface water (Figures 10 and 11, respectively). As counted in acre-feet per year, over twice as much groundwater as surface water is requested for use under these applications (Tables 3 and 4).

Quantities for Groundwater and Surface Water Claims

Information about groundwater and surface water claims was compiled from written records and the Water Rights Applications Tracking System (WRATS) database. Information on instantaneous and annual quantities for water right claims is not included in the WRATS database. Therefore, to evaluate water right claims, a reasonable instantaneous withdrawal and annual quantity was estimated according to the use of the water, based on the instantaneous and annual withdrawal standards specified in Quantity Allocation Standard Operating Procedure, POL-1070 and PRO-1070 (Table 5)[5]. For claims records associated with multiple purposes of use, the listed uses were evaluated individually.

A total of 2,004 claims (1712 groundwater and 292 surface water) were filed for WRIA 18. Groundwater claims totaled 21,672 gpm and 5,276 ac-ft/year, while surface water claims totaled 9.08 cfs and 5,273 ac-ft/year (Table 6). Instantaneous and annual quantities are also depicted by percentage of purpose of use for both groundwater (Figures 12 and 13, respectively) and surface water (Figures 14 and 15, respectively). As counted in acre-feet per year, annual quantity estimations for groundwater and surface water were nearly identical.

[4]Applications include a requested instantaneous and annual quantity, which was utilized at face value for quantity estimations. There were two exceptions, both surface water applications for domestic municipal use, where the annual quantity was estimated based upon the listed instantaneous withdrawal rate.

[5]Records without a listed purpose were not estimated, which accounted for less than 2% of the total number of claims records (21 of 1712 groundwater and 8 of 292 surface water records).

Assessing Certificates, Permits, Applications, and Changes:

1) Records with a single purpose of use, and lacking instantaneous and/or annual quantity allotments:
   a) For irrigation, domestic single, domestic general, and stock water, used the claims estimations
2) Records with multiple purposes of use, and associated with a single annual quantity
   d) Divided use proportionately among listed purposes by using values for estimating claims
   e) Looked at the actual "paper" documentation for "odd" records and those associated with domestic multiple (DM) and municipal (MU) use
   f) As necessary, consulted permit writers and "PRO-1070" (Water Resources Program Procedure for Water Quantity Allocation)

      For example, the Qi and Qa for group domestic use was eliminated and not counted for a number of Adjudicated certificates issued to irrigation companies (specifically: S2-17220, S2-17224, S2-17238, S2-17239, S2-17237, S2-17236, S2-17235, S2-17234, S2-17232, S2-17221)

Assessing "Supplemental Use":

Water right quantities issued for "supplemental use" represent a conservative estimation because totals include only information contained within the WRATS (Water Right Application Tracking System) database, and files may contain additional "supplemental use" allotments that were not tracked in WRATS "Supplemental" rights are issued as an administrative tool to provide flexibility within a given project or water system, and are not additive. Similar limitations exist for water rights with quantities issued for "seasonal" or "emergency" use.

Surface Water Anomalies:

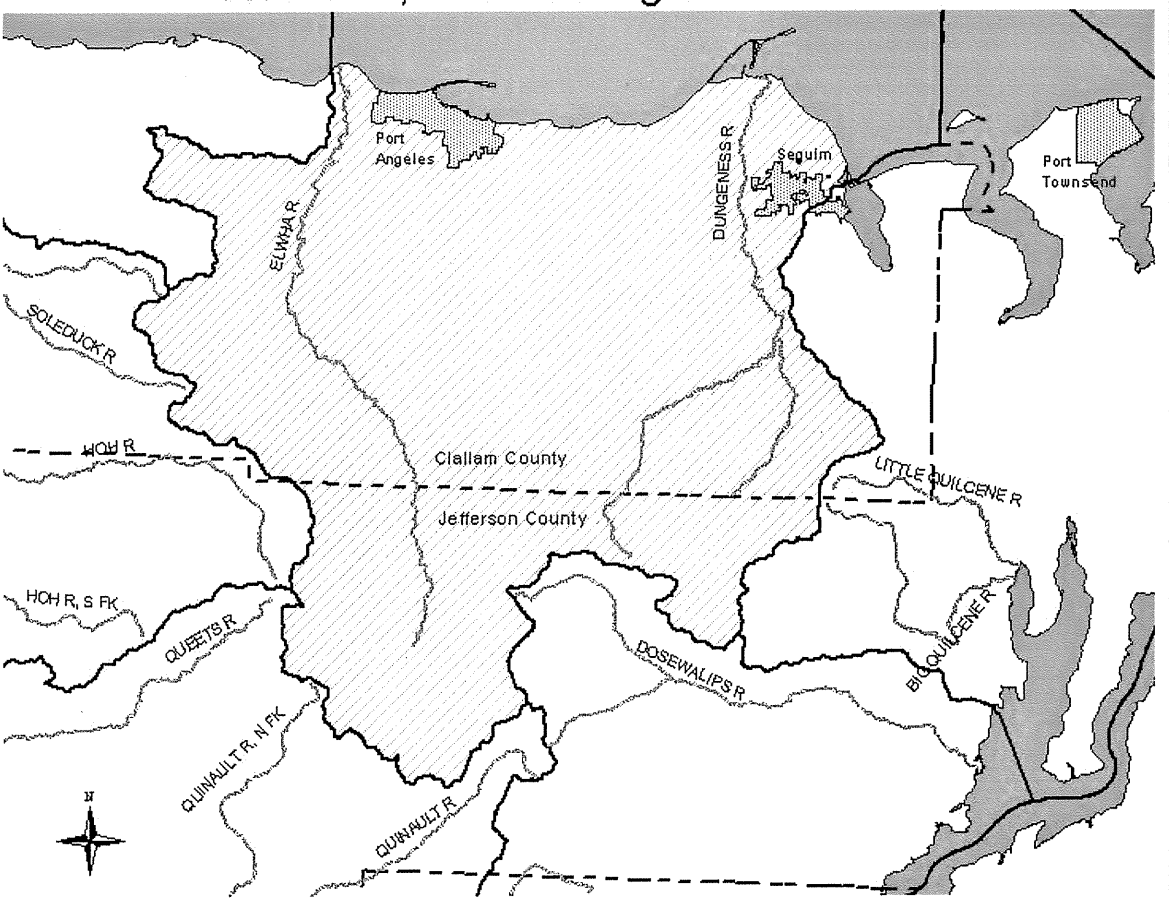
1) Group domestic use: Qi and Qa were eliminated and not counted (Adjudicated certificates for irrigation companies)
   (S2-17220, S2-17224, S2-17238, S2-17239, S2-17237, S2-17236, S2-17235, S2-17234, S2-17232, S2-17221)

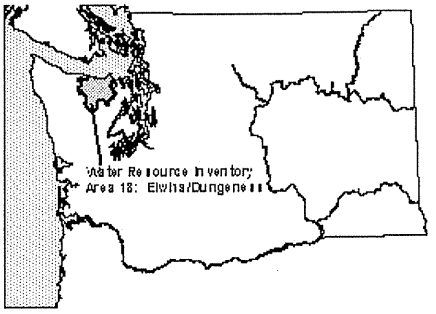
Assessing Claims:

1) If no purpose was listed, no quantity was estimated (29 records; 8 surface water and 21 groundwater)
2) Instantaneous and annual quantities were estimated in the following manner:

Purpose of Use	Qi (cfs)	Qi (gpm)	Qa (a-f/yr)
DG (domestic general)	0.02	9	0.5
DS (domestic single)	0.02	9	0.5
IR (irrigation)	0.02	9	multiply irrigated acres by 2
ST (stock water)	0.02	9	0.5

Figure 1: Location and General Features of WRIA 18, Elwha/Dungeness





Source:
Major River Ecology 1994 (m-rivers) 1:100k
County Boundary Ecology 1999 (county) 1:24k
WRIA Boundary/WRIA 18 Ecology 1998 (wria100k) 1:100k
Incorporated City WSDOT 2000 (city) 1:24k
Marine Waters Ecology 1996 (wash) 1:500k

ECOLOGY

Southwest Regional Office
5/19/2000
scale 1:450,000

Figure 2. Groundwater Certificates and Permits by Purpose of Use (Qi[gpm])

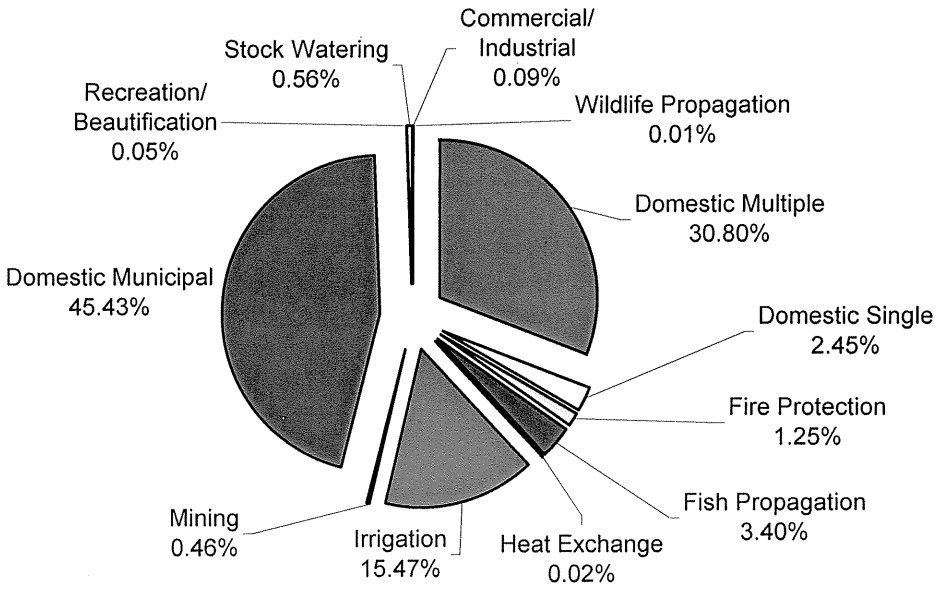


Figure 3. Groundwater Certificates and Permits by Purpose of Use (Qa[ac-ft/yr])

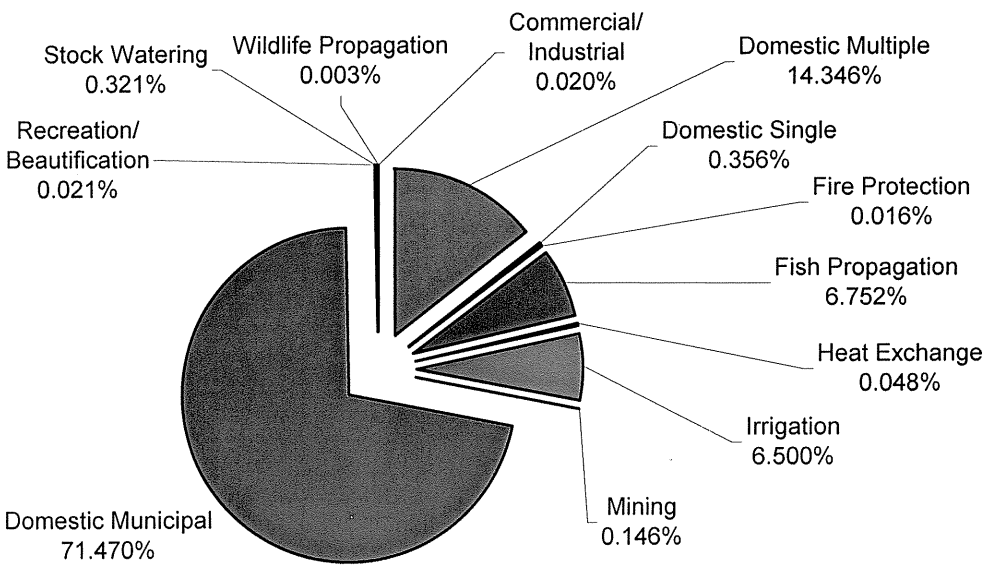


Figure 4. Surface Water Certificates and Permits by Purpose of Use (Qi[cfs])

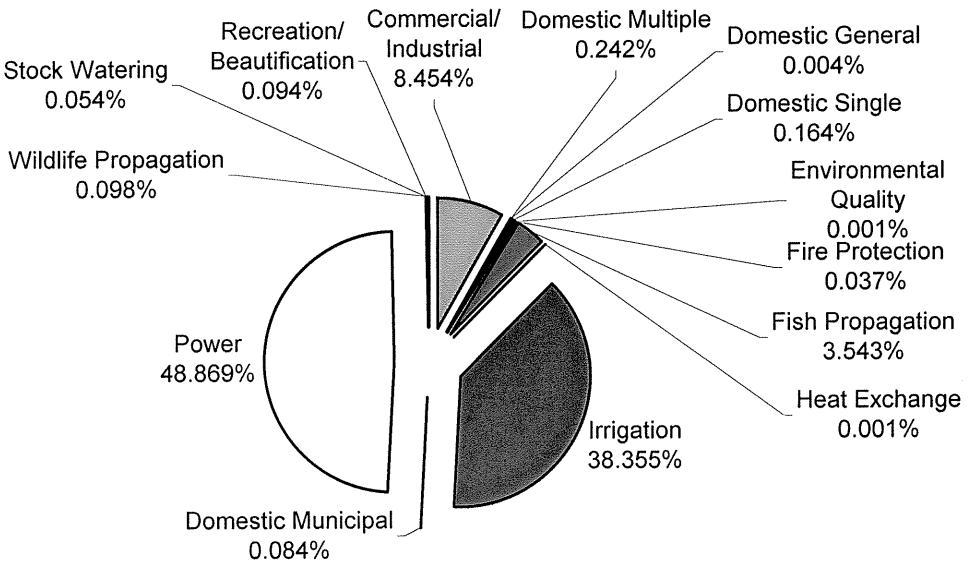


Figure 5. Surface Water Certificates and Permits by Purpose of Use (Qa[ac-ft/yr])

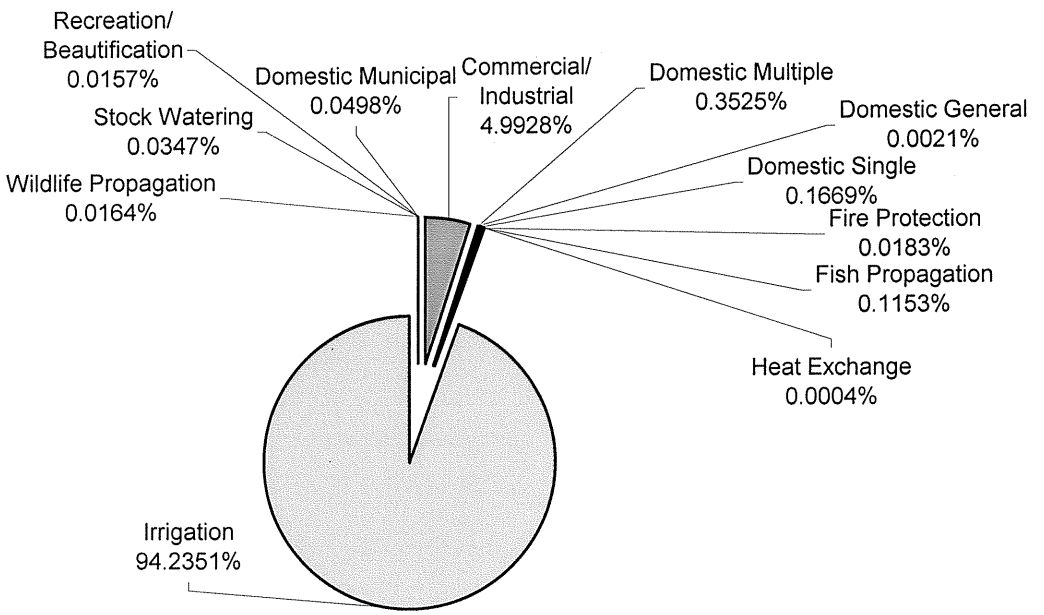


Figure 6. Growth of Groundwater Appropriations, Cumulative Instantaneous Quantity

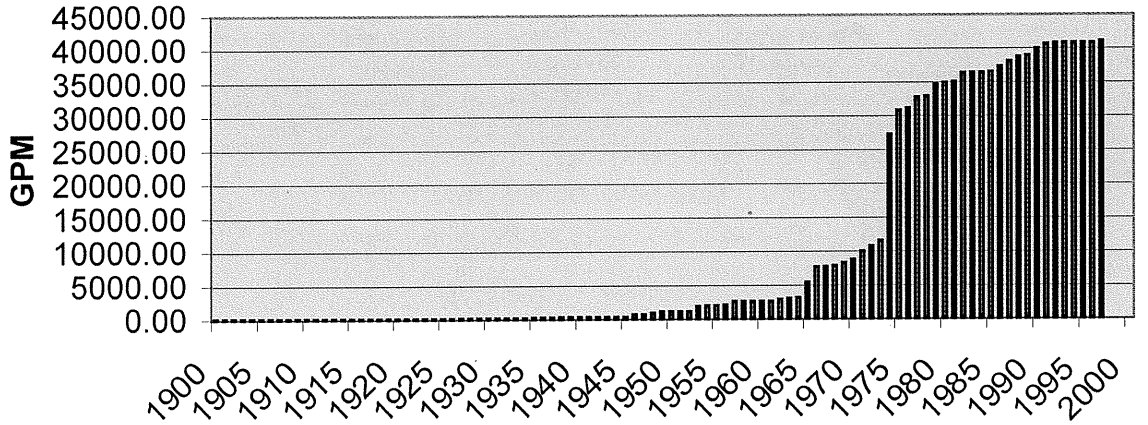


Figure 7. Growth of Surface Water Appropriations, Cumulative Instantaneous Quantity

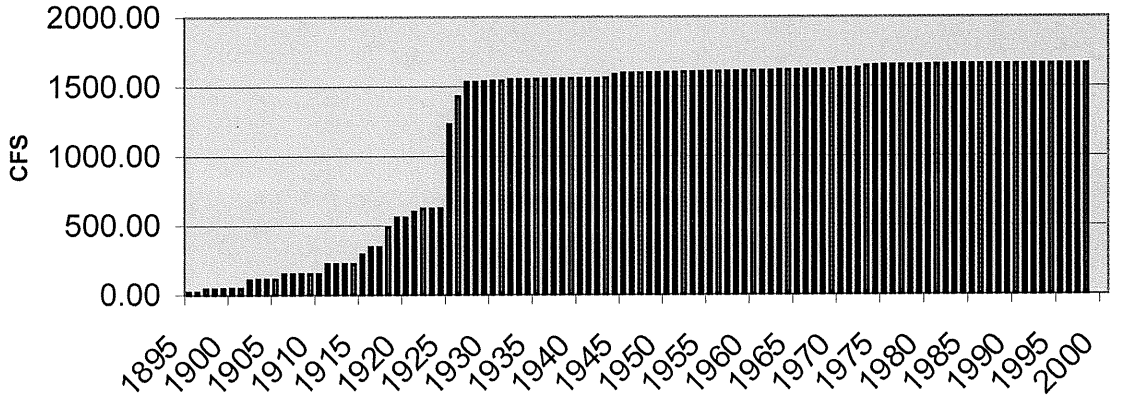


Figure 8. Groundwater Applications by Purpose of Use (Qi[cfs])

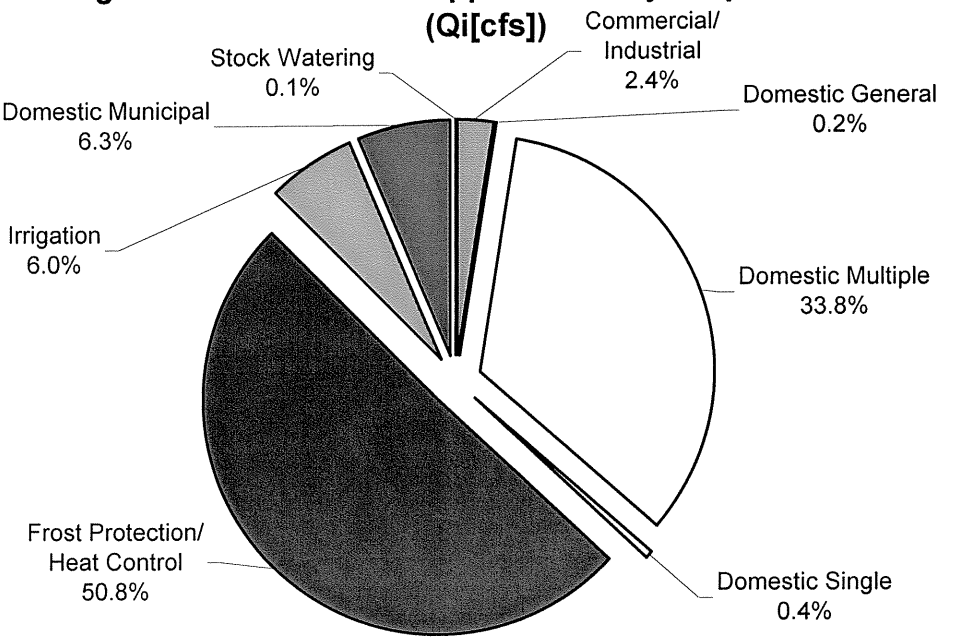


Figure 9. Groundwater Applications by Purpose of Use (Qa[ac-ft/yr])

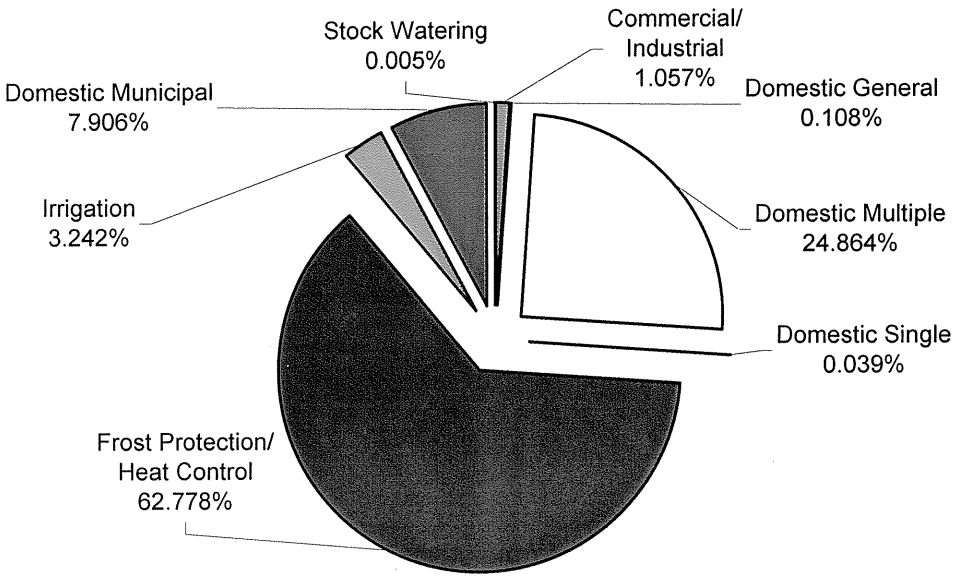


Figure 10. Surface Water Applications by Purpose of Use (Qi[cfs])

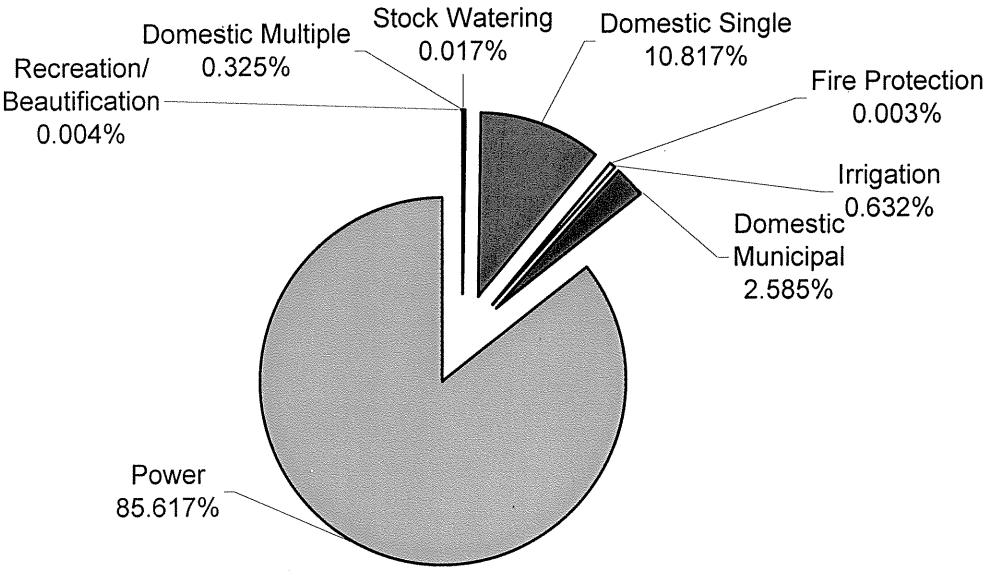


Figure 11. Surface Water Applications by Purpose of Use (Qa[ac-ft/yr])

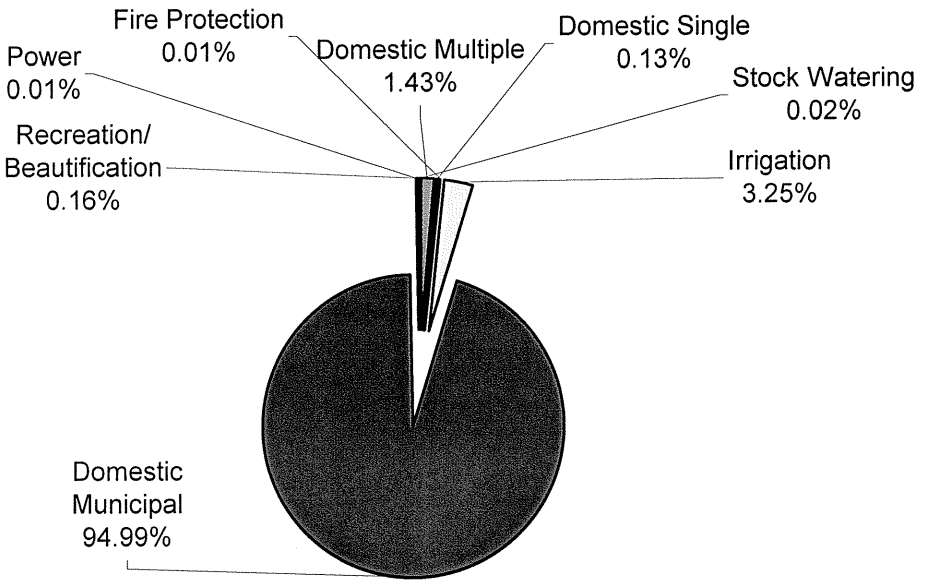


Figure 12. Groundwater Claims by Purpose of Use (Qi[gpm])

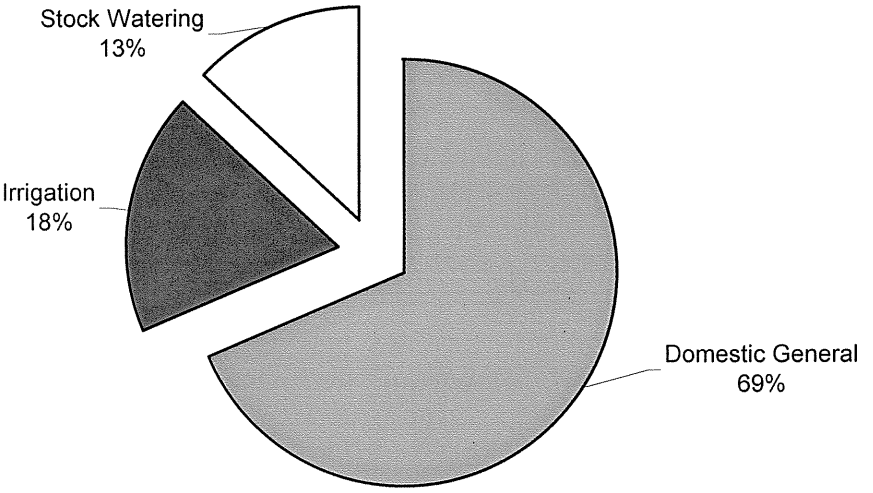


Figure 13. Groundwater Claims by Purpose of Use (Qa[ac-ft/yr])

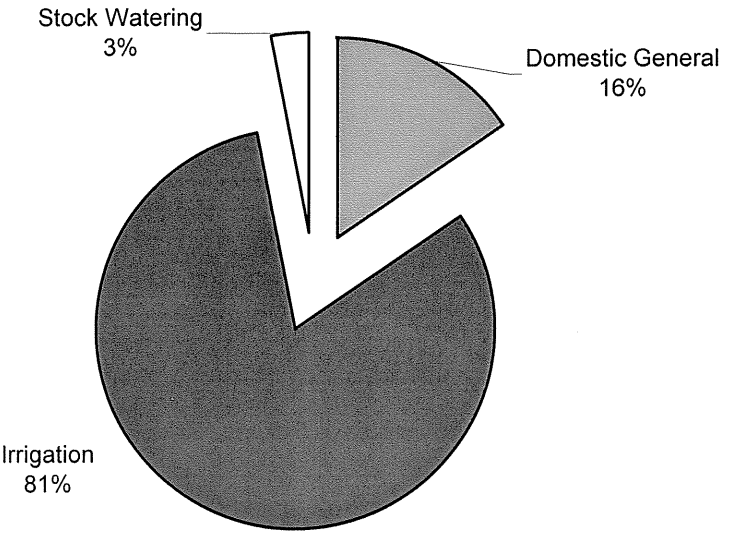


Figure 14. Surface Water Claims by Purpose of Use (Qi[cfs])

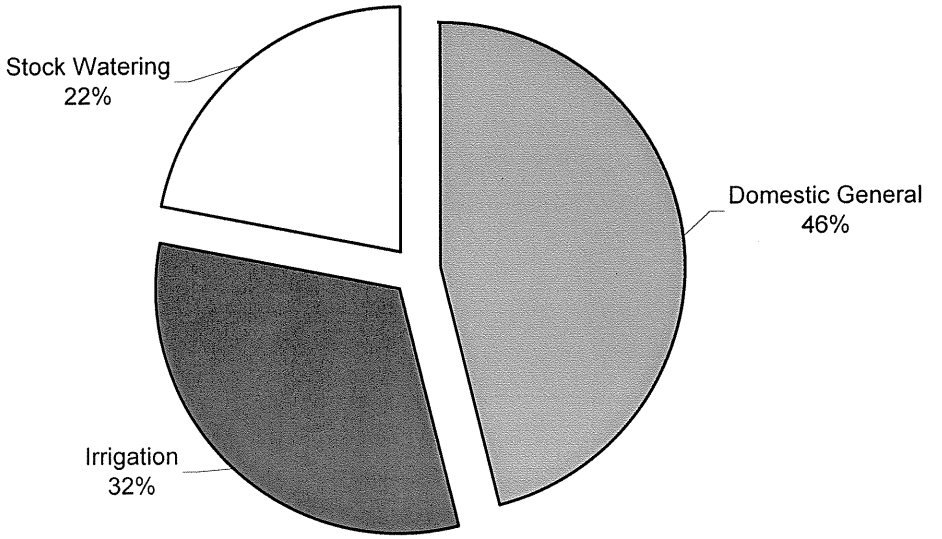


Figure 15. Surface Water Claims by Purpose of Use (Qa[cfs])

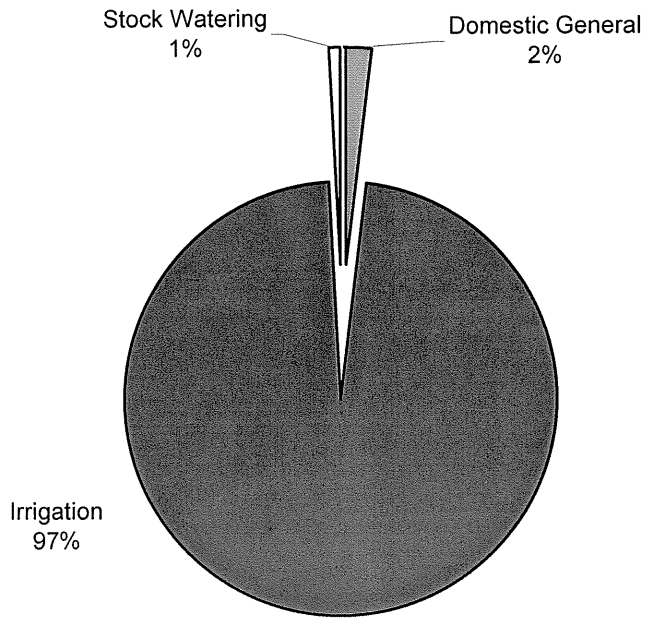


Table 1. Estimated Quantities for Groundwater Certificates and Permits

	Gross Total		Supplemental Use		Gross Total Minus Supplemental Use	
Type of Use	Qi (gpm)	Qa (ac-ft/yr)	Qi (gpm)	Qa (ac-ft/yr)	Qi (gpm)	Qa (ac-ft/yr)
Commercial/Industrial	37.80	6.70	n/a	n/a	37.80	6.70
Domestic Multiple	14,051.10	5,694.31	1,394.00	933.00	12,657.10	4,761.31
Domestic Single	1,025.00	120.30	20.00	2.00	1,005.00	118.30
Fire Protection	517.00	5.40	5.00	0.20	512.00	5.20
Fish Propagation	1,395.00	2,241.00	n/a	n/a	1,395.00	2,241.00
Heat Exchange	9.00	16.00	n/a	n/a	9.00	16.00
Irrigation	11,612.50	4,703.80	5,256.49	2,546.38	6,356.02	2,157.43
Mining	189.70	48.50	n/a	n/a	189.70	48.50
Domestic Municipal	29,918.00	25,571.00	11,250.00	1,850.00	18,668.00	23,721.00
Recreation/Beautification	21.90	7.01	n/a	n/a	21.90	7.01
Stock Watering	232.00	106.55	n/a	n/a	232.00	106.55
Wildlife Propagation	5.50	1.00	n/a	n/a	5.50	1.00
Total	59,014.50	38,521.57	17,925.49	5,331.58	41,089.02	33,189.99

Table 2. Estimated Quantities for Surface Water Certificates and Permits

	Gross Total		Supplemental Use		Gross Total Minus Supplemental Use	
Type of Use	Qi (cfs)	Qa (ac-ft/yr)	Qi (cfs)	Qa (ac-ft/yr)	Qi (cfs)	Qa (ac-ft/yr)
Commercial/Industrial	140.14	3,507.00	n/a	n/a	140.14	3,507.00
Domestic General	0.06	1.50	n/a	n/a	0.06	1.50
Domestic Multiple	14.10	267.38	10.05	19.10	4.01	247.60
Domestic Single	2.84	124.52	0.03	3.93	2.71	117.22
Environmental Quality	0.02	0.00	n/a	n/a	0.02	0.00
Fire Protection	0.61	12.88	n/a	n/a	0.61	12.88
Fish Propagation	109.24	1,331.00	50.00	1,250.00	58.73	81.00
Heat Exchange	0.01	0.25	n/a	n/a	0.01	0.25
Irrigation	639.69	67,003.80	3.86	810.23	635.81	66,192.08
Domestic Municipal	18.90	35.00	17.50	0.00	1.40	35.00
Power	810.11	0.00	n/a	n/a	810.11	0.00
Recreation/Beautification	1.56	11.00	n/a	n/a	1.56	11.00
Stock Watering	0.97	27.73	0.04	2.50	0.90	24.39
Wildlife Propagation	2.48	11.85	0.30	0.00	1.63	11.50
Total	1,740.72	72,333.91	81.78	2,085.75	1,658.95	70,248.16

Table 3. Estimated Quantities for Groundwater Applications

	Gross Total		Supplemental Use		Gross Total Minus Supplemental Use	
Type of Use	Qi (gpm)	Qa (ac-ft/yr)	Qi (gpm)	Qa (ac-ft/yr)	Qi (gpm)	Qa (ac-ft/yr)
Commercial/Industrial	187.00	107.80	n/a	n/a	187.00	107.80
Domestic General	12.30	11.00	n/a	n/a	12.30	11.00
Domestic Multiple	2,667.00	2,534.80	n/a	n/a	2,667.00	2,534.80
Domestic Single	35.00	4.00	n/a	n/a	35.00	4.00
Frost Protection/Heat Control	4,000.00	6,400.00	n/a	n/a	4,000.00	6,400.00
Irrigation	473.00	330.54	n/a	n/a	473.00	330.54
Domestic Municipal	600.00	967.00	100.00	161.00	500.00	806.00
Stock Watering	5.00	0.50	n/a	n/a	5.00	0.50
Total	7,979.30	10,355.64	100.00	161.00	7,879.30	10,194.64

Table 4. Estimated Quantities for Surface Water Applications

	Gross Total*	
Type of Use	Qi (cfs)	Qa (ac-ft/yr)
Domestic Multiple	0.76	66.00
Domestic Single	25.27	5.89
Fire Protection	0.01	0.30
Irrigation	1.48	150.28
Domestic Municipal	6.04	4,386.82
Power	200.02	0.50
Recreation/Beautification	0.01	7.24
Stock Watering	0.04	1.00
Total	233.62	4,618.03

*No supplemental use information was found for these records.

Table 5. Quantities Used to Estimate Groundwater and Surface Water Claims

	Qi		Qa
Type of Use	gpm	cfs	ac-ft/yr
Domestic General	9.00	0.02	0.50
Irrigation	9.00	0.02	2.0*
Stock Watering	9.00	0.02	0.50

*The irrigated acreage, if listed, was multiplied by 2 for annual quantity estimates.
If irrigated acreage was not listed, records were assigned an annual quantity of 2.0 ac-ft/year.

Table 6. Estimated Quantities for Groundwater and Surface Water Claims

	Groundwater Claims		Surface Water Claims	
Type of Use	Qi (gpm)	Qa (ac-ft/yr)	Qi (cfs)	Qa (ac-ft/yr)
Domestic General	14,841.00	824.50	4.18	104.50
Irrigation	3,996.00	4,294.00	2.90	5,118.00
Stock Watering	2,835.00	157.50	2.00	50.00
Total	21,672.00	5,276.00	9.08	5,272.50

Groundwater Certificates & Permits: Gross Total Minus Supplemental Use

Gross Year	Gross Total Qi	Gross Total Qa	Supp Year	Supp Use Qi	Supp Use Qa	Gross-Supp Qi	Gross-Supp Qi	Cumulative Qi (gpm by year)	Cumulative Qa (by year)
1900	300	50	1900	112.485	18.375	187.515	31.625	188	32
1907	8	12				8	12	196	44
1927	25	10				25	10	221	54
1928	10	12				10	12	231	66
1935	80	12.5				80	12.5	311	78
1938	75	65				75	65	386	143
1946	3500	1897	1946	3150	1750	350	147	736	290
1948	225	20				225	20	961	310
1949	230	20				230	20	1,191	330
1951	765	282	1951	765	282	0	0	1,191	330
1953	758	1182				758	1182	1,949	1,512
1954	70	28				70	28	2,019	1,540
1956	120	38				120	38	2,139	1,578
1957	500	248				500	248	2,639	1,826
1959	160	44	1959	160	44	0	0	2,639	1,826
1961	10	7.6	1961	10	2	0	5.6	2,639	1,832
1962	300	30				300	30	2,939	1,862
1963	120	78.2				120	78.2	3,059	1,940
1964	100	160				100	160	3,159	2,100
1965	2280	1280.9				2280	1280.9	5,439	3,381
1966	2882.5	938.13	1966	600	246	2282.5	692.13	7,721	4,073
1967	53	18	1967	5	1	48	17	7,769	4,090
1968	142	96				142	96	7,911	4,186
1969	450	322.7				450	322.7	8,361	4,509
1970	454	87.3				454	87.3	8,815	4,596
1971	1382	597.5	1971	150	120	1232	477.5	10,047	5,073
1972	991.5	272.9	1972	235	63	756.5	209.9	10,804	5,283
1973	941	240	1973	132	49.4	809	190.6	11,613	5,474
1974	24792	21411.55	1974	9070	72	15722	21339.55	27,335	26,814
1975	3555	2955.5				3555	2955.5	30,890	29,769
1976	334	109				334	109	31,224	29,878
1977	1573	381.55				1573	381.55	32,797	30,260
1978	203	73.4	1978	28	2.9	175	70.5	32,972	30,330
1979	1682	859.3				1682	859.3	34,654	31,189
1980	365	57.5	1980	86	16	279	41.5	34,933	31,231
1981	150	25.4				150	25.4	35,083	31,256
1982	1520	792.9	1982	195	268.8	1325	524.1	36,408	31,780
1983	50	22				50	22	36,458	31,802
1985	104	15				104	15	36,562	31,817
1986	781	40.496				781	40.496	37,343	31,858
1987	915	400	1987	152	33	763	367	38,106	32,225
1988	913	437.05	1988	250	215	663	222.05	38,769	32,447
1989	723	261.2	1989	500	240	223	21.2	38,992	32,468
1990	1086	530.61	1990	45	4.2	1041	526.41	40,033	32,995
1991	668	143.13	1991	30	53.9	638	89.23	40,671	33,084
1992	156.5	17.25				156.5	17.25	40,827	33,101
1993	62	9				62	9	40,889	33,110
1995	2250	1850	1995	2250	1850	0	0	40,889	33,110
1997	200	80				200	80	41,089	33,190
						41089.015	33189.991		

Groundwater Certificates & Permits: Gross Total Minus Supplemental Use

Gross Year	Cumulative Qi (gpm by year)	Cumulative Qa (by year)
1900	187.52	31.63
1901	187.52	
1902	187.52	
1903	187.52	
1904	187.52	
1905	187.52	
1906	187.52	
1907	195.52	43.63
1908	195.52	
1909	195.52	
1910	195.52	
1911	195.52	
1912	195.52	
1913	195.52	
1914	195.52	
1915	195.52	
1916	195.52	
1917	195.52	
1918	195.52	
1919	195.52	
1920	195.52	
1921	195.52	
1922	195.52	
1923	195.52	
1924	195.52	
1925	195.52	
1926	195.52	
1927	220.52	53.63
1928	230.52	65.63
1929	230.52	
1930	230.52	
1931	230.52	
1932	230.52	
1933	230.52	
1934	230.52	
1935	310.52	78.13
1936	310.52	
1937	310.52	
1938	385.52	143.13
1939	385.52	
1940	385.52	
1941	385.52	
1942	385.52	
1943	385.52	
1944	385.52	
1945	385.52	
1946	735.52	290.13
1947	735.52	
1948	960.52	310.13
1949	1190.52	330.13
1950	1190.52	
1951	1190.52	330.13
1952	1190.52	
1953	1948.52	1512.13

Gross Year	Cumulative Qi (gpm by year)	Cumulative Qa (by year)
1954	2018.52	1540.13
1955	2018.52	
1956	2138.52	1578.13
1957	2638.52	1826.13
1958	2638.52	
1959	2638.52	1826.13
1960	2638.52	
1961	2638.52	1831.73
1962	2938.52	1861.73
1963	3058.52	1939.93
1964	3158.52	2099.93
1965	5438.52	3380.83
1966	7721.02	4072.96
1967	7769.02	4089.96
1968	7911.02	4185.96
1969	8361.02	4508.66
1970	8815.02	4595.96
1971	10047.02	5073.46
1972	10803.52	5283.36
1973	11612.52	5473.96
1974	27334.52	26813.51
1975	30889.52	29769.01
1976	31223.52	29878.01
1977	32796.52	30259.56
1978	32971.52	30330.06
1979	34653.52	31189.36
1980	34932.52	31230.86
1981	35082.52	31256.26
1982	36407.52	31780.36
1983	36457.52	31802.36
1984	36457.52	
1985	36561.52	31817.36
1986	37342.52	31857.85
1987	38105.52	32224.85
1988	38768.52	32446.90
1989	38991.52	32468.10
1990	40032.52	32994.51
1991	40670.52	33083.74
1992	40827.02	33100.99
1993	40889.02	33109.99
1994	40889.02	
1995	40889.02	33109.99
1996	40889.02	
1997	41089.02	33189.99
1998	0.00	
1999	0.00	
2000	0.00	

Groundwater Certificates & Permits: Gross Total Minus Supplemental Use

Gross Year	Cumulative Qi (gpm by year)	Cumulative Qa (by year)
1900	187.52	31.63
1901	187.52	
1902	187.52	
1903	187.52	
1904	187.52	
1905	187.52	
1906	187.52	
1907	195.52	43.63
1908	195.52	
1909	195.52	
1910	195.52	
1911	195.52	
1912	195.52	
1913	195.52	
1914	195.52	
1915	195.52	
1916	195.52	
1917	195.52	
1918	195.52	
1919	195.52	
1920	195.52	
1921	195.52	
1922	195.52	
1923	195.52	
1924	195.52	
1925	195.52	
1926	195.52	
1927	220.52	53.63
1928	230.52	65.63
1929	230.52	
1930	230.52	
1931	230.52	
1932	230.52	
1933	230.52	
1934	230.52	
1935	310.52	78.13
1936	310.52	
1937	310.52	
1938	385.52	143.13
1939	385.52	
1940	385.52	
1941	385.52	
1942	385.52	
1943	385.52	
1944	385.52	
1945	385.52	
1946	735.52	290.13
1947	735.52	
1948	960.52	310.13
1949	1190.52	330.13
1950	1190.52	
1951	1190.52	330.13
1952	1190.52	
1953	1948.52	1512.13

Gross Year	Cumulative Qi (gpm by year)	Cumulative Qa (by year)
1954	2018.52	1540.13
1955	2018.52	
1956	2138.52	1578.13
1957	2638.52	1826.13
1958	2638.52	
1959	2638.52	1826.13
1960	2638.52	
1961	2638.52	1831.73
1962	2938.52	1861.73
1963	3058.52	1939.93
1964	3158.52	2099.93
1965	5438.52	3380.83
1966	7721.02	4072.96
1967	7769.02	4089.96
1968	7911.02	4185.96
1969	8361.02	4508.66
1970	8815.02	4595.96
1971	10047.02	5073.46
1972	10803.52	5283.36
1973	11612.52	5473.96
1974	27334.52	26813.51
1975	30889.52	29769.01
1976	31223.52	29878.01
1977	32796.52	30259.56
1978	32971.52	30330.06
1979	34653.52	31189.36
1980	34932.52	31230.86
1981	35082.52	31256.26
1982	36407.52	31780.36
1983	36457.52	31802.36
1984	36457.52	
1985	36561.52	31817.36
1986	37342.52	31857.85
1987	38105.52	32224.85
1988	38768.52	32446.90
1989	38991.52	32468.10
1990	40032.52	32994.51
1991	40670.52	33083.74
1992	40827.02	33100.99
1993	40889.02	33109.99
1994	40889.02	
1995	40889.02	33109.99
1996	40889.02	
1997	41089.02	33189.99
1998	0.00	
1999	0.00	
2000	0.00	

Surface Water Certificates and Permits: Gross Minus Supplemental Use

PYR	Qi (cfs)	Qa (ac-ft/yr)	Cumulative Qi (cfs by year)	Cumulative Qa (by year)
1895	20.00	2000.50	20.00	2000.50
1896			20.00	
1897	23.08	2308.50	43.08	4309.00
1898			43.08	
1899	4.00	401.00	47.08	4710.00
1900	1.00	101.00	48.08	4811.00
1901			48.08	
1902	60.00	6000.50	108.08	10811.50
1903	3.84	410.00	111.92	11221.50
1904			111.92	
1905			111.92	
1906	40.20	4000.50	152.12	15222.00
1907			152.12	
1908			152.12	
1909			152.12	
1910			152.12	
1911	70.94	7094.50	223.06	22316.50
1912			223.06	
1913			223.06	
1914			223.06	
1915	70.14	7014.50	293.20	29331.00
1916	52.36	5236.50	345.56	34567.50
1917	0.00	0.00	345.56	34567.50
1918	146.00	14600.50	491.56	49168.00
1919	66.00	5100.50	557.56	54268.50
1920	0.00	0.00	557.56	54268.50
1921	42.00	4200.50	599.56	58469.00
1922	22.50	500.00	622.06	58969.00
1923			622.06	
1924	2.20	115.50	624.26	59084.50
1925	605.90	510.50	1230.16	59595.00
1926	201.82	120.50	1431.98	59715.50
1927	100.20	2520.00	1532.18	62235.50
1928	1.01	150.75	1533.19	62386.25
1929	3.40	645.75	1536.59	63032.00
1930	4.27	501.00	1540.86	63533.00
1931	0.52	40.50	1541.38	63573.50
1932	10.00	1000.00	1551.38	64573.50
1933			1551.38	
1934	0.15	0.50	1551.53	64574.00
1935	2.00	40.50	1553.53	64614.50
1936	0.50	40.00	1554.03	64654.50
1937	1.66	67.50	1555.69	64722.00
1938	0.21	21.50	1555.89	64743.50
1939	0.61	114.50	1556.50	64858.00
1940	0.23	53.00	1556.73	64911.00
1941	1.90	313.00	1558.63	65224.00
1942	0.03	4.50	1558.66	65228.50
1943	0.25	0.50	1558.91	65229.00
1944	26.00	220.50	1584.91	65449.50
1945	9.01	1496.23	1593.93	66945.73
1946	1.41	268.00	1595.33	67213.73
1947	0.12	30.50	1595.45	67244.23
1948	1.02	80.50	1596.47	67324.73

PYR	Qi (cfs)	Qa (ac-ft/yr)	Cumulative Qi (cfs by year)	Cumulative Qa (by year)
1949	0.01	0.63	1596.48	67325.35
1950	1.62	254.00	1598.10	67579.35
1951	1.74	95.00	1599.84	67674.35
1952	1.41	230.50	1601.25	67904.85
1953	1.21	308.50	1602.46	68213.35
1954	2.10	196.25	1604.56	68409.60
1955	0.34	61.50	1604.90	68471.10
1956	0.01	0.25	1604.91	68471.35
1957	0.17	25.25	1605.08	68496.60
1958	0.15	0.50	1605.23	68497.10
1959	4.40	166.75	1609.63	68663.85
1960	0.44	81.00	1610.07	68744.85
1961	0.40	52.75	1610.47	68797.60
1962	0.64	153.75	1611.11	68951.35
1963	3.01	37.25	1614.12	68988.60
1964	0.58	69.00	1614.70	69057.60
1965	0.66	76.31	1615.35	69133.91
1966	1.24	14.50	1616.59	69148.41
1967	0.35	54.50	1616.94	69202.91
1968	0.39	78.10	1617.33	69281.01
1969	0.12	3.25	1617.45	69284.26
1970	9.20	67.75	1626.65	69352.01
1971	1.16	17.13	1627.81	69369.14
1972	2.05	81.92	1629.85	69451.06
1973	15.85	44.21	1645.70	69495.27
1974	2.50	381.26	1648.20	69876.52
1975	0.66	156.25	1648.86	70032.77
1976	1.02	33.60	1649.88	70066.37
1977	0.04	1.50	1649.92	70067.87
1978	0.19	33.40	1650.10	70101.27
1979	0.13	4.25	1650.23	70105.52
1980	0.95	85.50	1651.18	70191.02
1981	4.06	5.13	1655.24	70196.15
1982	0.20	3.75	1655.44	70199.90
1983	1.68	16.15	1657.13	70216.05
1984	0.02	0.00	1657.15	70216.05
1985	0.02	1.00	1657.17	70217.05
1986	0.02	1.00	1657.19	70218.05
1987	0.37	11.00	1657.56	70229.05
1988	0.04	2.00	1657.60	70231.05
1989	0.07	6.00	1657.67	70237.05
1990	0.09	7.51	1657.76	70244.56
1991	0.05	1.18	1657.81	70245.74
1992	0.10	1.37	1657.91	70247.11
1993	0.03	0.68	1657.94	70247.79
1994			1657.94	
1995			1657.94	
1996	1.00	0.00	1658.94	70247.79
1997			1658.94	
1998	0.01	0.37	1658.95	70248.16
1999			0.00	
2000			0.00	
	1658.95	70248.16		