



State of the Estuary Report 2015

Technical Appendix

People – Recycling Water

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TECHNICAL APPENDIX: RECYCLED WATER USE

CONTEXT

Most of the surface and ground water consumed by urban users in the Bay Area is treated to drinking water standards, used once, treated again to remove pollutants, and discharged from 34 publicly owned treatment works (POTW) into the Bay and its tidal sloughs and streams (see Figure 1).¹ Much of this consumption, including the 40% used for landscaping, does not necessarily require drinking water for its use. Until recently, treating the wastewater to recyclable standards was expensive compared to treating and distributing freshwater diverted from local and imported sources.² Reusing gray water from showers, bathroom sinks and laundry on-site was prohibited until recently. As a result of these limitations, a relatively small amount of intentional water recycling has occurred over the last 50 years in the Bay Area. Efforts over the last three decades have increased and made recycled water a more important part of the Bay Area's water portfolio. On-site reuse of graywater, rainwater, and stormwater is also increasing but still a very small percentage of the total recycled water use.

In the Bay Area, recycled water from POTW's is used to irrigate landscapes, golf courses, and crops; for process water, including power plant and refinery cooling water and washdown water at commercial and industrial facilities; and to augment flow to wetlands or create new ones. Proposed new uses of recycled water in the region include toilet flushing in commercial buildings, heating and cooling, and for groundwater recharge.

Water recycling demonstrates good stewardship because it uses the limited local and imported water supplies more efficiently and appropriately, with the potential of reducing the need for new water diversions from the Bay's watershed. Compared to existing supplies, recycled water is much less sensitive to climate-induced supply variation and often consumes less energy than pumping water from the Delta or pumping groundwater (BACWA, 2007).³ Water recycling supports the region's sustainability by providing a local and available source of water and because the

¹ Nearly all of the urban Bay Area is "sewered" and connected to publicly owned treatment works (POTW). The rural fringes of the Bay still rely on individual septic tanks or small facilities that discharge into groundwater. Some industrial users such as refineries, chemical companies, and shoreline businesses such as C&H Sugar discharge their wastewater directly into the Bay. Wastewater can be discharged into North Bay streams during the winter season when runoff is higher.

² Recycled water must meet the standards in Title 22 of the California Code of Regulations and in accordance with a Regional Water Quality Control Board (RWQCB) permit, such as National Pollutant Discharge Elimination System (NPDES), waste discharge requirements (WDR), or water recycling requirements (WRR)

³ Energy consumption for recycled water depends on the distance and elevational difference of the end user and treatment plant.

wastewater is primarily discharged into or near the Bay, and not part of a downstream supply, it is a “new” source of water for the region and the State. Water recycling also reduces the amount of treated wastewater that is discharged into the Bay. It can also reduce the amount of nitrogen and phosphorous-rich wastewater discharged into the Bay, which locally can accelerate algal growth. In sum water recycling can meet multiple resource management and protection objectives.⁴

INDICATOR

Recycled water is quantified for four years (2001, 2005, 2010, and 2014) with two metrics⁵: 1) the total amount of water recycled, treated, and distributed from wastewater treatment plants to provide for a beneficial use. Beneficial uses, as defined by state water quality law, include domestic supply, agriculture, aquaculture, recreation, navigation, water quality, and fish and wildlife preservation; and 2) the surface and groundwater supply usable for drinking water, which the recycled water offsets (potable offset).

The recycled water that offsets potable supply is quantified into four categories based upon its end use: landscape irrigation, commercial, industrial, and agriculture.⁶ The recycled water that is used in a way that does not offset potable water but still provides a beneficial use is quantified in two categories. The largest category is for creating and enhancing wetland habitat around the Bay.⁷ The second category is recycled water applied by treatment plants to non-irrigated surroundings to grow grass or forage crops. In both of these cases, the discharged water is getting additional treatment, expanding the region’s available water portfolio, and providing a beneficial use.

DATA SOURCES

Multiple data sources must be used to quantify annual recycled water use because the reporting requirements and definitions for the different categories recycled water use have not been standardized. Data inconsistencies arise because of differing definitions of what is classified as recycled water with some agencies quantifying only the portion that offsets potable uses and other agencies quantifying all wastewater that is used for any beneficial use including in-plant use and land irrigation used for wastewater disposal. There is also not a consistent delineation between the different categories (commercial, industrial, irrigation) of recycled water use. The California Department of Water Resources (DWR), through its 2015 guidelines for preparing Urban Water Management Plans (UWMP’s) and coordination with recycled water surveys by the State Water Resources Control Board (State Board) and the Bay Area Clean Water

⁴ Recycling is not without its critics who note its high capital costs, increased concentration of total dissolved solids, and growth-inducing aspects.

⁵ Consistent annual data is not readily available.

⁶ Recycled water used for crop irrigation (e.g. vineyards) and cultural practices (dairies) which replaces untreated groundwater or surface water that is potentially potable is quantified as a potable offset.

⁷ A small amount of recycled water is used for wildlife habitat in ponds in parks and other public spaces.

Agencies (BACWA,) is attempting to standardize the reporting of recycled water use (DWR 2015).

The following sources were used in the data compilation:

1. The San Francisco Bay Regional Water Quality Control Board (Regional Board) 96-011 recycled water annual reports required by Order 96-011 General Water Reuse Requirements for Municipal Wastewater and Water Agencies. Many but not all POTW's and water agencies that provide recycled water file 96-011 reports or report their use through their NPDES permit reports. The Regional Board now receives most of the 96-011 reports in digital form. Much of the 2014 data compilation started with these reports although some were missing data or reported the quantity of recycled water inconsistently with other reports. When available 96-011 reports for the earlier years (2005 and 2010) were also used.
2. Some of the 2010 and 2014 data was obtained directly from the wastewater treatment plant operator (e.g. Napa Sanitation District, Las Gallinas Sanitary District) or from the distributor or consumer of the water, either a water agency (e.g. EBMUD) or the direct consumer (e.g. turf farm). The quantities reported in the 96-011 reports and the amounts the water suppliers reported were not always consistent.⁸
3. The 2010 UWMP's for the water supply agencies distributing recycled water were consulted, especially for projects that did not have 96-011 reports for 2005 or 2010 although that data was not always consistent with the other sources.
4. Recycled water use from 2001 was compiled for The Bay Institute's 2003 Ecological Scorecard (TBI 2003). That data was obtained from the treatment plant operators and water agencies and from the 2001 State Water Board Recycled Water Survey. The 2001 data was reanalyzed for this report to insure consistency with the current assessment and thus includes data from the North Bay counties (Marin, Sonoma, Napa, Solano) whereas the 2003 report only included data from the five counties covered by the Bay Area Regional Water Recycling Program (San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa).

BENCHMARKS, TARGETS AND GOALS

There are no standardized benchmarks, goals or targets for assessing progress of recycled water use in the Bay region.⁹ The following are the approaches used in this assessment:

⁸ The discrepancies may arise when the amount of recycled water actually used and reported in the 96-011 reports can be less than the amount treated to the recyclable standards but not used. Or sometimes the amount demanded by the entity using the recycled water (e.g. Chevron refinery) exceeds the amount that the POTW can produce who then must use potable water to supplement the recycled water to meet the demand.

⁹ Statewide goals for recycled water have been established by the State Water Board but they are not based upon any regional assessments; rather they are based upon existing uses in 2003 and projections for use in 2020 and 2030 (Toni Pezzetti, pers com)

1. Comparing recycled water used to the total amount of water treated or “produced” at wastewater treatment plants, usually expressed as a percentage. Regional Water Quality Control Board records indicate that the amount treated at San Francisco Region POTW’s was about 194 billion gallons or about 595,000 ac-ft.¹⁰ Some entities establish goals to maximize the use of wastewater. E.g. the City of San Jose established a goal in 2007 to beneficially reuse 100% of its wastewater by 2022 (<https://www.sanjoseca.gov/index.aspx?NID=2951>)
2. Comparing recycled water used for potable offset to the potable water demand. For example, Santa Clara Valley Water District has a goal of expanding recycled water use so that it supplies at least 10% of countywide water demands by 2025 (SCVWD 2014). The 2014 potable water demand for the San Francisco Bay region is 828,660 ac-ft .
3. Comparing the recycled water used to published planning targets and projections. There are many plans and projections for recycled water use in the Bay Region, some of which include targets for recycled water use. In 1999 the Bay Area Regional Water Recycling Program projected that for the five county region (San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa) Water recycling projects in the Bay Area could produce as much as 125,000 acre feet a year by 2010 and 240,000 acre feet a year by 2025 if funding were available and institutional constraints were reduced (BARWMP, 1999 and BACWA 2006). The North Bay Water Reuse program projects a recycled water potential of 36,500 ac-ft in Marin, Sonoma, and Napa Counties although the three alternatives analyzed for implementation project smaller amounts available for reuse (BACWA 2006, North Bay Water Reuse web-site project description <http://nbwra.org/projects/3alternatives.html>). The 2006 Bay Area Integrated Regional Water Management Plan identifies 27 projects that could produce up to 120 TAF/YR of recycled water by the year 2020 (BACWA 2006). The individual water agencies that prepare UWMP’s are required to produce projections for the recycled water production and use through the year 2035. The plans and projections are based upon an assessment of future supply and demand for recycled water and, depending on the projection, a greater or lesser evaluation of the economic viability and funding availability. For this assessment the BARWRP projection for 2010 is compiled, recognizing that many of the assumptions made in 1999 about demand and funding availability have not been realized. The projections made for 2015 in the 2010 UWMP’s were compiled by DWR (Toni Pezzitti, May 29 e-mail) and by BACWA in their 2011 survey. The two compilations were similar, with a projection of 70 TAF of recycled use in 2015.¹¹

¹⁰ E-mail from Vince Christian, Region 2 staff engineer, on June 18, 2015

¹¹ BACWA’s 2011 survey included about 10.4 TAF of internal use at POTW’s which DWR does not include. When the internal use is removed, DWR and BACWA numbers are nearly the same.

RESULTS

Results of this assessment are displayed in Table 1 for 2001, 2005, 2010, 2014 and Figure 2, which graphically displays the results for 2001 and 2014. For 2014 Table 1 displays the amount of recycled water for each of the major categories by each “recycler” or producer of recycled water. The recyclers are grouped by region (East Bay, South Bay, Peninsula, and North Bay).

Total use steadily grew from 2001 to 2014 by 23 thousand acre-feet (TAF), an 80% increase, to 52 TAF, which represents about 9% of the wastewater produced at POTW’s. The amount that offset potential potable water grew more - 26 TAF or a 158% increase - up to 42 TAF, which represents about 5% of the urban demand in 2014. The biggest increase since 2001 in offsetting potable use was by the Chevron refinery and the new and expanded use by power plants for process and cooling water. Offsetting landscape and agricultural irrigation demand grew over 10 TAF since 2001, nearly doubling, with over 1500 sites receiving recycled water for irrigation in 2014. The use of recycled water to create and enhance wetlands and further clean the water prior to its discharge into the Estuary increased modestly with the addition in 2014 of the Napa-Sonoma salt pond complex. The recycled water use in 2014 appears to have declined from 2013 in some areas as the mandatory conservation requirements reduced demand for landscape irrigation and reduced water treated at the POTW’s.

Recycled water use is a small but an increasingly important part of the Bay Area’s water portfolio. The extended drought and new infusion of government grants will accelerate the use of it. The projections of recycled water use are expected to increase when they are updated again later in 2015 as the continuing drought has amplified the value and reliability of recycled water.

The region, however, has not been able to achieve targets and projections for its use and lags behind other urbanized regions of the State in its use. The 2014 recycled water use is about 74% of the projections made in 2010 for 2015, and 34% of the ambitious but outdated targets established in 1999 for 2010 use in the 5-county region (excluding the North Bay) by the Bay Area Regional Water Recycling Program. The shortfall in developing recycled water up to now is due to project costs and funding limitations, market demand, and customer/public acceptance.

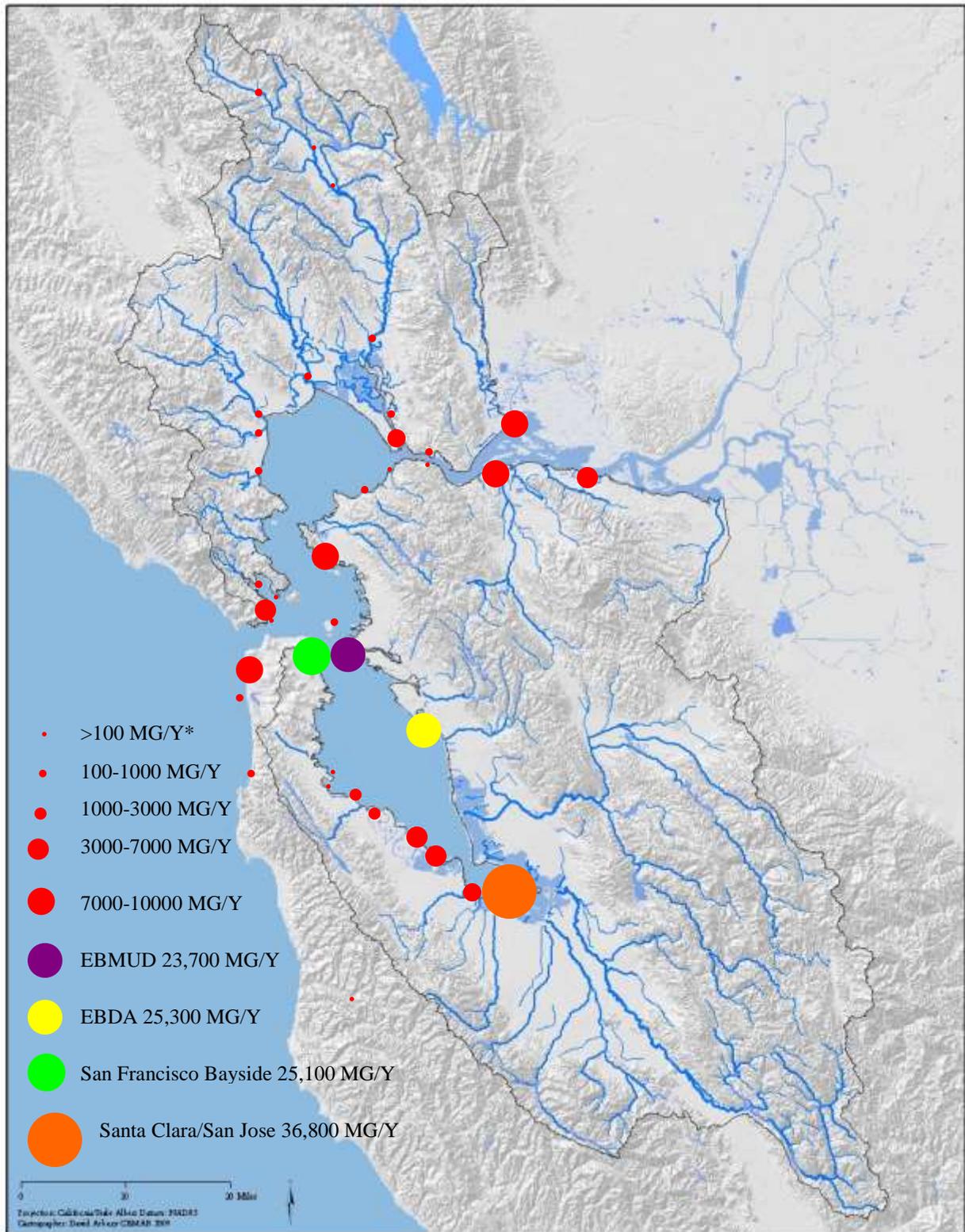
THREATS AND CHALLENGES

Despite the Bay Area’s extreme dependence on imported water, its relatively high reliability and low cost up to now has inhibited the use of recycled water. The current awareness of our regions vulnerability to drought, warming climate and natural disasters has significantly heightened the interest in the use of recycled water. A portion of the wastewater stream may never be economically feasible to develop for traditional irrigation, industrial, and commercial uses of recycled water from POTW’S

because of the current mismatch between wastewater discharge locations and recycled water demand locations. On-site treatment and reuse for indoor and outdoor non-potable uses is becoming more feasible particularly in new developments. Residential users are also increasing their on-site reuse to meet their outdoor water demand as new building codes have facilitated its acceptance.

The greatest potential to significantly increase recycled water use in the near term is for groundwater recharge into the aquifers of the Santa Clara Valley, southern and eastern Alameda County and the North Bay for indirect potable reuse. The direct potable reuse of wastewater by putting it into reservoirs and distribution pipelines is in the more distant future, even though direct potable reuse already occurs in other parts of the world and water-short areas in the United States. To fully realize this potential, Bay Area residents and businesses will need to overcome their concerns about the perceived risks of recycled water and embrace it as one of the most viable means of achieving a more sustainable water future.

Figure 1. Locations of Region 2 POTW Discharges



* MG/Y = million gallons per year

From Region 2 draft staff report on Water Recycling in the SF Bay

TABLE 1: RECYCLED WATER USE IN THE SAN FRANCISCO BAY REGION IN 2014, 2010, 2005, AND 2001

All values in acre-feet for 2014 except where noted											
Region	County	Distributor / Customer	Source Water Operator	Total	Potable Offset	Landscape Irrigation	Industrial	Commercial	Agriculture	Agriculture non-offset	Wetlands & Wildlife
East Bay	Alameda	EBMUD	EBMUD Main WWTP	173	173	173	0	1	0	0	0
East Bay	Alameda	EBMUD	San Leandro WPCP	321	321	321	0	0	0	0	0
East Bay	Alameda	San Leandro	San Leandro WPCP	301	301	301					
East Bay	Alameda	Hayward	Oro Loma/Castro Valley	242	242	242	0	0	0	0	0
East Bay	Alameda	Livermore	City of Livermore	1,078	1,078	997	77	1	3	0	0
East Bay	Alameda	Hayward Marsh	Union Sanitary District	3,810	0	0	0	0	0	0	3,810
East Bay	Alameda	Russell City Energy Center	Hayward WPCP	1,747	1,747		1,747				
East Bay	Contra Costa	CCWD	Central Contra Costa SD	437	437	436		1	0	0	0
East Bay	Contra Costa	CCWD	Delta Diablo Sanitation District	7,824	7,824	526	7,297	0	0	0	0
East Bay	Contra Costa	Peyton Slough	Mt. View Sanitation District	2,240	0	0	0	0	0	0	2,240
East Bay	Contra Costa	DSRSD	Dublin San Ramon Services District	2,572	2,572	2,413	158	0	0	0	0
East Bay	Contra Costa	EBMUD- R.A.R. E.	West County Wastewater District	2,289	2,289	0	2,289	0	0	0	0
East Bay	Contra Costa	EBMUD- Chevron	West County Wastewater District	3,771	3,771	0	3,771	0	0	0	0
East Bay	Contra Costa	EBMUD	from Dublin San Ramon	715	715	715	0	0	0	0	0
Peninsula	San Francisco	SFPUC	Southeast Treatment Plant	2	2	2	2				
Peninsula	San Mateo	Redwood City	South Bayside System Authority	714	714	702	13	0	0	0	0
Peninsula	San Mateo	SFPUC/Daly City	Daly City	792	792	792	0	0	0	0	0
Peninsula	San Mateo	Pacifica/North Coast CWD	North Coast County WD	21	21	21					
Peninsula	San Mateo	SF Airport	San Francisco Int'l Airport	26	26		26				
South Bay	Santa Clara	San Jose etc.	San Jose/Santa Clara WPCP	10,884	10,884	7,073	3,811	0	0	0	0
South Bay	Santa Clara	Sunnyvale	Sunnyvale WPCP	205	205	195	8	2	0	0	0
South Bay	Santa Clara	Palo Alto	Palo Alto Regional WQCP	1,858	881	516	363	2	0	0	941
North Bay	Marin	MMWD	Las Gallinas SD	588	588	588	0	0	0	0	0
North Bay	Marin	North Marin WD	Novato SD	1,770	259	259	0	0	0	951	560
North Bay	Marin	North Marin WD	Las Gallinas SD	159	159	159					
North Bay	Marin	Mill Valley	Sewerage Agency South Marin	30	21	21					9
North Bay	Napa	American Canyon	American Canyon	141	141	115	0	0	26	0	0
North Bay	Napa	Napa and Ag	Napa Sanitation District	1,777	1,336	1,305	17		14	441	0
North Bay	Napa	Calistoga	Calistoga	399	341	336	5	0	0	58	0
North Bay	Napa	Yountville and Ag	Yountville	367	367	34	0	1	331	0	0
North Bay	Solano	Turf farm	Fairfield Suisun Sewer District	1,171	1,171	0	0	28	1,143	0	0
North Bay	Sonoma	Petaluma	Petaluma WR Facility	1,574	666	635	25	0	6	909	0
North Bay	Sonoma	Agriculture	Sonoma Valley County SD	2,431	1,803	0	0	0	1,803	0	629
East Bay				27,521	21,471	6,125	15,340	2	3	0	6,050
Peninsula				1,555	1,555	1,514	41	0	0	0	0
South Bay				12,947	11,970	7,784	4,183	4	0	0	977
North Bay				10,408	6,852	3,453	46	29	3,323	0	1,198
2014 total	9 counties			52,432	41,848	18,876	19,610	35	3,327	2,359	8,225
2010 total	9 counties			46,108	35,608	14,945	17,055	512	3,096	2,958	7,542
2010 minus North Bay	5 counties			37,105	30,124	12,719	16,924	478	3	0	6,982
2005 total	9 counties			35,756	25,187	12,057	12,922	6	173	3,685	6,886
2001 total	9 counties			29,094	16,219	9,392	4,865	32	1,930	5,559	7,317
% change from 2010-2014				14%	18%	26%	15%	-93%	7%	-20%	9%
% change from 2001-2014				80%	158%	101%	303%	11%	72%	-58%	12%

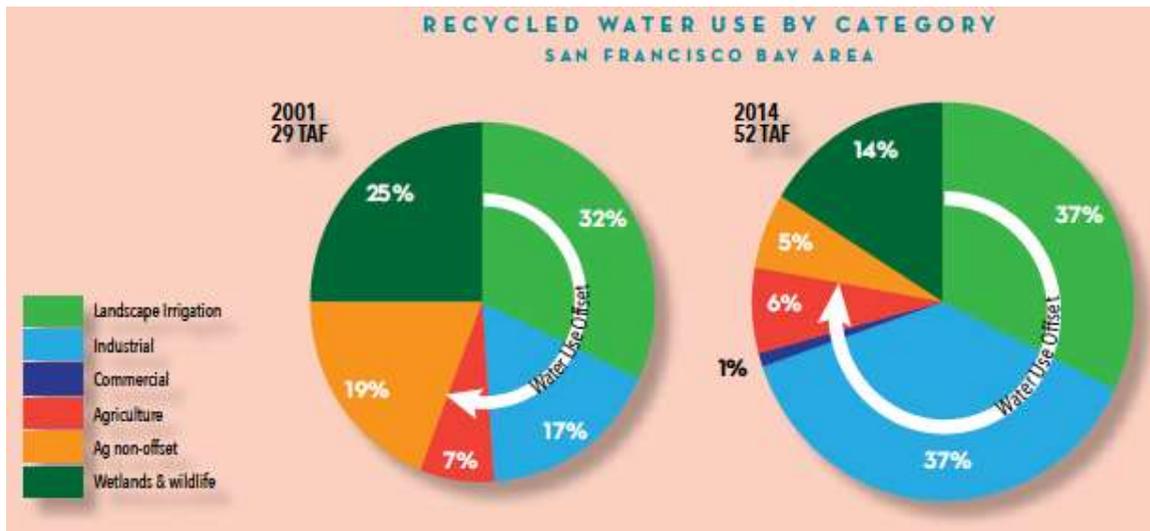
TABLE 2. RECYCLED WATER USE BENCHMARKS, TARGETS AND PROJECTIONS

Year	Total recycled use	Potable offset	Potable offset as a % of total	1999 BARWRP target	2011 BACWA projections	Total wastewater produced	Total recycled as % of wastewater produced	Potable demand in Bay region	Potable offset as % of demand
2001	29,094	16,219	56%						
2005	35,756	25,187	70%						
2010	46,108	35,608	77%	125,000		613,000	7.5%	864,667	4.1%
2014	52,432	41,848	80%			595,000	8.8%	828,660	5.1%
2015					69,806				
2020					87,324				

Notes

1. Values in acre-feet unless otherwise noted
2. BACWA projections without internal use
3. BARWRP target for 5 county region - does not include North Bay counties

FIGURE 2



Citations

Bay Area Clean Water Agencies (BACWA) 2006 Wastewater and Recycled Water Functional Area Document 125 pp available at <http://bairwmp.org/docs/functional-area-documents/bay-area-clean-water-agencies-resolution-to-adopt>

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Bay Area Regional Water Recycling Program (BARWRP) 1999 San Francisco Bay Area Regional Water Recycling Program recycled water master plan Lafayette CA

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The Bay Institute (TBI) 2003 San Francisco Bay Index Novato CA 84 pp available at <http://www.thebayinstitute.org/resources/publications/ecological-scorecards>