8 Wastewater and Recycled Water

8.1 Program Description

This section presents a summary of wastewater and recycled water applications in the Livermore Valley. As part of this program, Zone 7 compiles and reviews data on the volume and quality of wastewater collected and recycled water used within the watershed from the Livermore Wastewater Recycling Plant (LWRP), and Dublin San Ramon Services District (DSRSD) Water Reclamation plant. Onsite disposal of wastewater from the Veterans Hospital sewage treatment plant and individual septic systems within the groundwater basin are also accounted for in this section.

Wastewater disposal concerns have been greatly reduced in the valley through the implementation of municipal wastewater treatment and export projects and the restriction of high-density unsewered development over the Main Basin in the 1970's and early 1980's. In the late 1980's and early 1990's, Zone 7 partnered with the cities, wastewater agencies, and the permitting agency (RWQCB) to develop a master water recycling permit. The permit goals were essentially to maximize the beneficial use of recycled water while protecting the groundwater basin from possible water quality degradation. One of the permit conditions was to develop a Salt Management Plan (*Section 12.1.1*) to ensure beneficial uses of the local groundwater basin were preserved and that groundwater quality was not impaired. The resulting program to manage local resources requires that wastewater disposal and recycled water use be monitored to determine the quantity, the quality, and the impact on the local resources. The City of Livermore and DSRSD are responsible for treating and monitoring the majority of wastewater and all recycled water used within the Valley. Zone 7 reviews their monitoring program data and evaluates potential impacts of recycled water on the local groundwater resources.

Zone 7 views recycled water as a valuable water resource that should be included as a part of a diversified water portfolio, when managed appropriately. The risk for negative groundwater impacts is greatly reduced when the wastewater has gone through a water reclamation or recycling process prior to its use. In addition, recycled water use contributes to the stored groundwater volume when incidental percolation occurs during irrigation of landscapes and crops. On the other hand, onsite disposal of wastewater from domestic, commercial and industrial sites, if disposed to the land, can have a negative impact on groundwater quality. Therefore, care should be taken to limit the density of septic tanks or other onsite wastewater disposal systems.

8.2 2014 Results

8.2.1 Municipal Wastewater and Recycled Water

The results of the Zone 7 Wastewater Monitoring Program for the 2014 WY (October 2013 through September 2014) are presented in *Figure 8-A* below. The two largest wastewater collection and treatment works are LWRP and the DSRSD, which treat over 99% of the wastewater in the Valley. Both of these publically owned treatment works (POTW) produce secondary-treated effluent, which is exported from the valley through the Livermore-Amador Valley Water Management Agency (LAVWMA) export pipeline, and tertiary-treated recycled water primarily for irrigation of urban landscapes. Currently, none of the recycled water is used for groundwater replenishment projects.

Figure 8-A: Recycled Water Volumes (AF) for the 2014 Water Year

	Livermore (LWRP)	**DSRSD**	**Total**
Wastewater Influent	7,154	11,469	18,623
Treated Effluent Exported via LAVWMA	5,010	8,178*	13,188
Total Volume Recycled	2,136	3,152	5,288
Recycled Volume-Main Basin**	1,413	0	1,413

* Does not include Zone 7 Demin Plant discharge to LAVWMA via DSRSD
** Only the portion of recycled water which was applied over Main Basin landscapes.

"Total Volume Recycled" represents the total volume of recycled water used by each entity within the watershed, whereas, "Recycled Volume-Main Basin" shows the volumes of recycled water that were applied only over the Main Basin during the 2014 WY. The remainder of the recycled water was applied over fringe basin and upland areas. Also, only a small portion of the water applied as irrigation percolates to the groundwater supply; most of the applied water is evaporated, taken up by plant roots or exists as moisture in the unsaturated soil. In general, less than about three percent of groundwater supply comes from incidental recharge of recycled water.

In the 2014 WY, a total of 18,623 AF of municipal wastewater was treated at the two POTWs, of which about 28% was recycled (25% in 2013 WY) and used primarily for landscape irrigation: 2,136 AF by LWRP and 3,152 AF by DSRSD. About 66% (1,413 AF) of the recycled water produced by LWRP was applied to landscapes over the Main Basin, whereas the remaining 34% and all of DSRSD's recycled water was applied on areas outside of the Main Basin; primarily on areas overlying the Dublin and Camp fringe basins and the Tassajara uplands. The total municipal wastewater treated has decreased over the last two years (20,500 AF in 2012 WY and 19,904 AF in 2013 WY) likely because of indoor conservation efforts over the last two years.

Recycled water accounted for less than 3% of the Main Basin's groundwater inflow component (i.e., recharging waters) in the 2014 WY. The superior benefit of the recycled water use in the 2014 WY was that it conserved up to 5,288 AF of potable water which, due to the low allocation from the State Water Project, might have come from groundwater storage. Another way of looking at irrigation with recycled water is as an uninterruptable supply, allowing green landscaping even during periods when significant reductions in outdoor irrigation with potable water resulted in many brown lawns.

8.2.2 Recycled Water Quality

The recycled water from both wastewater plants met the State Department of Public Health "Title 22" water quality standards for irrigation uses during the 2014 WY. While salt and nutrients are the primary constituents-of-concern for wastewater and recycled water applications over the Main Basin, other potential constituents-of-emerging-concern (CECs) and their surrogates would need to be monitored if recycled water was used in aquifer recharge projects. *Figure 8-B* below presents the concentration ranges of salts (measured as TDS) and nitrogen compounds in the applied recycled water during the 2014 WY.

Figure 8-B: Wastewater Quality (mg/L, except where noted) for the 2014 Water Year

Compound	Livermore (LWRP)	DSRSD
SALTS		
Total Dissolved Solids (TDS)	550 - 730	600 - 834
NITROGEN COMPOUNDS		
Nitrogen (as NO_3)	ND	ND – 3.18
Nitrogen (as NO_2)	0.69 - 0.95	0.92 - 4.46
Total Kjeldahl Nitrogen (TKN)	0.22 - 47	19 - 50
Nitrogen Loading (lbs/AF)	**1 - 129**	**53 - 138**

TDS concentrations in the portion applied directly on the Main Basin ranged from 550 to 730 mg/L. Zone 7 assumes that all of the salt mass in the applied water is carried downward by the percolate and eventually reaches groundwater. This leads to a conservative (potentially high) estimate of the salt loading attributed to their applications. About 1,049 tons (about 10%) of the Main Basin's gross salt loading (10,976 tons) was attributed to recycled water use over the Main Basin during the 2014 WY. However, if potable water supplies would have been used for this irrigation demand, the salt loading would have been about 300 tons less. By comparison Zone 7's Mocho Groundwater Demineralization Plant (MGDP) removed over 1,040 tons of salt in the 2014 WY.

The three nitrogen compounds in the table represent the nitrogen content potentially available for conversion to nitrate as the water percolates through the soil. The bottom row of the table shows the total nitrogen loading (in pounds of nitrogen per AF) from all three of these compounds. However, from a practical standpoint, some of the nitrogen will be removed from the percolate through soil denitrification and plant uptake processes.

8.2.3 Future Recycled Water Use

Both Livermore and DSRSD plan to expand the use of recycled water for turf and landscape irrigation projects over the next few years. Similarly, Pleasanton is planning to use recycled water from DSRSD and/or Livermore for irrigation of city parks and landscapes located over the Main Basin. Although recycled water is currently only a minor contributor to the salt accumulation in the Main Basin, the average TDS concentration of the applied recycled water tends to be over twice the average TDS concentration of the fresh water served by Zone 7. Therefore, the expansion of recycled water use for irrigation should be carefully planned along with expansion of demineralization facilities to minimize impacts to salt loading, whether the demineralized water is used for irrigation or other uses.

Mitigation of the water quality concerns related to salt loading from recycled water use is addressed in Zone 7's Salt Management Plan (*Zone 7, 2004*) (*Section 12.1.1*). This plan is currently being augmented with a Nutrient Management Plan (NMP) addendum to make it comparable to the Salt/Nutrient Management Plan (SNMP) required under State Water Board's new Recycled Water Policy (*State Water Board, Resolution No. 2009-0011, adopted February 2009*). Because there is already an approved SMP for the Livermore Valley Groundwater Basin, a new SNMP is not required. In the process, Zone 7 is collaborating with Livermore, DSRSD, and Pleasanton to incorporate future planned recycled water use expansions, and to plan for future groundwater demineralization facilities to mitigate for the potential impact to groundwater and delivered water quality. The nutrient management addendum was adopted by the Zone 7 Board in June 2015.

8.2.4 Other Applied Wastewater

There is a small amount of untreated wastewater that is discharged to the Main Basin as leachate from the leaky Veteran's Administration (VA) Hospital wastewater treatment ponds located in southern Livermore, from onsite domestic wastewater systems (septic systems), and from leaking wastewater and recycled water pipelines that run throughout the Groundwater Basin. The results estimated for the 2014 WY are presented in *Figure 8-C* below.

Figure 8-C: Wastewater Volumes (AF) for the 2014 Water Year

	VA Hospital*	Septic Tanks*	Pipe Leakage**	Total
Wastewater Leachate	50	80	400	530

* Estimated
** Calculated. Includes leakage from sanitary sewer and recycled water pipes

The contribution to the Main Basin groundwater supply (530 AF) was estimated using "typical" wastewater flows from domestic septic systems, a fixed estimate for the VA Hospital ponds and the pipe leakage calculation described in *Section 10.3.2.4* since actual discharges are not monitored. There have been no significant changes in land uses or septic system densities over the Main Basin that would change the estimated water contribution from these sources in recent years.

Figure 8- below presents the estimated concentration ranges of salts (measured as TDS) and nitrogen compounds in the applied wastewater for the 2014 WY.

Figure 8-D: Wastewater Quality (mg/L, except where noted) for the 2014 Water Year

Compound	VA Hospital	Septic Tank Leachate	Sanitary Sewer Pipe Leakage
SALTS			
Total Dissolved Solids (TDS)	440 - 770	500-700	550 - 834
NITROGEN COMPOUNDS			
Nitrogen (as NO_3)	ND - 16	ND - Trace	ND – 3.18
Nitrogen (as NO_2)	ND	ND - Trace	0.69 - 4.46
Total Kjeldahl Nitrogen (TKN)	3.8 - 43	50-90*	0.22 - 50
Nitrogen Loading (lbs/AF)	**10 - 127**	**136 - 245**	**1 - 138**

* Estimated

The three nitrogen compounds in the table represent the nitrogen content potentially available for conversion to nitrate as the water percolates through the soil. The bottom row of the table shows the total nitrogen loading (in pounds of nitrogen per AF) from all three of these compounds. However, from a practical standpoint, some of the nitrogen will be removed from the percolate through soil denitrification and potentially, plant uptake processes.

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