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DRAFT
Westside Sacramento Integrated Regional Water Management Plan

SECTION 3 – WATER MANAGEMENT SYSTEM

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DRAFT Table of Contents

List of Tables ii

List of Figures iii

Section 3: Water Management System 3-1

3.1 Water Supplies and Demands 3-1
3.1.1 Regional Water Balance 3-1
3.1.1.1 Water Entering 3-3
3.1.1.2 Water within the Region 3-3
3.1.1.3 Water Leaving 3-9
3.1.2 Water Balance Comparison 3-9
3.1.3 Upper Watersheds Water Balance 3-12
3.1.4 Valley Floor Water Balance 3-15
3.2 Water Quality 3-18
3.2.1 Water Quality Regulatory Framework 3-18
3.2.2 Surface Water Quality 3-19
3.2.3 Imported Water Quality 3-23
3.2.4 Groundwater Quality 3-24
3.2.5 Wastewater and Recycled Water Quality 3-26
3.2.5.1 Upper Cache Creek and Upper Putah Creek 3-26
3.2.5.2 Valley Floor 3-26
3.3 Flood Management 3-27
3.3.1 Flood Management Infrastructure 3-27
3.3.2 Upper Cache Creek 3-30
3.3.2.1 People and Property at Risk 3-30
3.3.2.2 Description of Flood Hydrology and Facilities in Upper Cache Creek – Lake County 3-30
3.3.3 Upper Putah Creek 3-32
3.3.3.1 People and Property at Risk in Upper Putah Creek – Napa and Lake Counties 3-32
3.3.3.2 Description of Flood Hydrology and Facilities in Upper Putah Creek- Napa and Lake Counties 3-34
3.3.4 Valley Floor 3-34
3.3.4.1 People and Property at Risk in the Northern Valley Floor – Yolo County 3-36
3.3.4.2 Description of Flood Hydrology and Facilities in Northern Valley Floor – Yolo County 3-36
3.3.4.3 People and Property at Risk in the Southern Valley Floor – Yolo and Solano Counties 3-37
3.3.4.4 Description of Flood Hydrology and Facilities in the Southern Valley Floor – Yolo and Solano County 3-38

DRAFT Table of Contents (cont'd)

3.4 Environmental Resources 3-39
3.4.1 Fisheries..3-39
3.4.1.1 Cache Creek Fisheries 3-39
3.4.1.2 Putah Creek Fisheries 3-40
3.4.2 Waterfowl 3-41
3.4.3 Important Ecologic Areas and Conservation Efforts 3-41
3.4.4 Non-Native Species 3-42
3.5.2 Summary of Climate Change Vulnerability Checklist.............3-44
3.5.2.1 Flooding 3-44
3.5.2.2 Water Demand..3-47
3.5.2.3 Water Supply 3-47
3.5.2.4 Water Quality 3-47
3.5.2.5 Ecosystem and Habitat Vulnerability 3-47

List of Tables

Table 3-1: Major Lakes and Reservoirs..3-4
Table 3-2: Average Year Applied Water Summary..3-6
Table 3-3: Dry Year Applied Water Summary 3-7
Table 3-4: UWMP Baseline GPCD Factors 3-7
Table 3-5: Wastewater Treatment Plants and Disposal Methods..3-8
Table 3-6: Regional Water Balance Summary – Average Year (2035) 3-10
Table 3-7: Regional Water Balance Summary – Dry Year (2035).....................................3-11
Table 3-8: Westside Region Surface Water Bodies and Beneficial Uses..........................3-19
Table 3-9: Groundwater Quality Constituents of Concern 3-24

DRAFT Table of Contents (cont'd)

List of Figures

Figure 3-1: Water Balance Schematic 3-2
Figure 3-2: Water Infrastructure 3-5
Figure 3-3: Average Year – Upper Cache Planning Area 3-13
Figure 3-4: Dry Year – Upper Cache Planning Area 3-14
Figure 3-5: Average Year – Upper Cache Planning Area 3-14
Figure 3-6: Dry Year – Upper Putah Planning Area 3-15
Figure 3-7: Average Year – Valley Floor Planning Area 3-17
Figure 3-8: Dry Year – Valley Floor Planning Area 3-17
Figure 3-9: 303(d) Impaired Streams & Water Bodies 3-20
Figure 3-10: Potential Sources of Mercury Impairments & Impaired Streams & Water Bodies 3-21
Figure 3-11: FEMA Floodplains Westside Region 3-28
Figure 3-12: Flood Management Infrastructure 3-29
Figure 3-13: FEMA Floodplains Upper Cache Creek 3-31
Figure 3-14: FEMA Floodplains Upper Putah Creek 3-33
Figure 3-15: FEMA Floodplains Valley Floor 3-35
Figure 3-16: Annual Temperature Increases 3-45
Figure 3-17: Increased Wildfire Risk 3-46

Section 3: Water Management System

This section contains a description of the water management system of the Westside Region and key challenges that are expected through the year 2035. A region the size of Westside Sacramento is extremely complex and challenging to manage. This description portrays how water moves through the Region and some of the challenges encountered along the way in order to provide a broad understanding of the water-related interactions of relevant natural features and man-made infrastructure.

A simplified water balance helps illustrate the quantities of water that enter, are used, and leave the Region. This high-level perspective illustrates our planning assumptions about supply and demand throughout the planning period. While the nodes and links of the water balance show numbers for water quantity, the schematic and associated information also provide useful information about the high-level interactions that can affect water quality, flood management, and ecosystem health. Finally, this section also contains a presentation of the potential influences climate change may have on the Region.

Additional data, analyses, and detailed descriptions used to form the information presented in this section can be found in Appendix 3-X.

3.1 Water Supplies and Demands

This section contains a description of the current and expected conditions of water supplies and demands over the planning horizon. A water balance was used to promote a regional understanding of the diversified nature of surface water and groundwater supplies and provide a more holistic understanding of water supply and demand. The water balance is intended to be used as a tool for identifying potential areas for improving water management, especially opportunities to collaborate more or improve the balance between supplies and demands. Separate water balances were prepared for the Upper Cache, Upper Putah, and Valley Floor Planning Areas to explore and illustrate the differences and interrelationships across the region.

3.1.1 Regional Water Balance

Movement of water through the Region is a complex process. Users within the region access many different sources of water, take advantage of a variety of ways to store water for later use, and apply that water for a variety of beneficial uses. Some specific data and information about various aspects of how water moves through the region currently do not exist. Much of the missing information correlates with the historical agricultural practices within the Region. The majority of the water used within the Region is applied for agricultural production, and agricultural practices within the Region result from thousands of independent choices made by individual landowners and farmers. The agricultural community seems to have adapted their practices to accommodate significant annual fluctuations in the availability of water supplies.

Many of the water users within the Region employ conjunctive use and have access to both surface water and groundwater, but some water users rely on a single source of supply. Proceeding subsections contain descriptions of the water balance components shown in Figure 3-1.

The water balances were prepared using water supply and demand information available at 5-year intervals through the planning horizon for two scenarios: an average condition (representing normal conditions) and a dry water year (representing potential drought conditions). Only hydrologic data that was available in a consistent format across the entire region was used. Hydrologic data for the years 1980 through 2000 was averaged to represent an average water year condition, and the data for 1988 was selected as a representative dry water year for the Region.

The difference between an “average” and “dry” water year can be seen in comparing the average rainfall in the Upper Cache Creek watershed between 1954 and 2011 at 27.57 inches with a low of 8.17 inches of precipitation in 1976. A water balance based on data from a single year can provide a useful “snapshot” of water management conditions, but does depict some important long-term management factors such as changes in storage. Conducting a water balance for representative multiple dry years may be beneficial for users within the Region in future updates, but was not prepared in this Plan due to the unavailability of needed information.

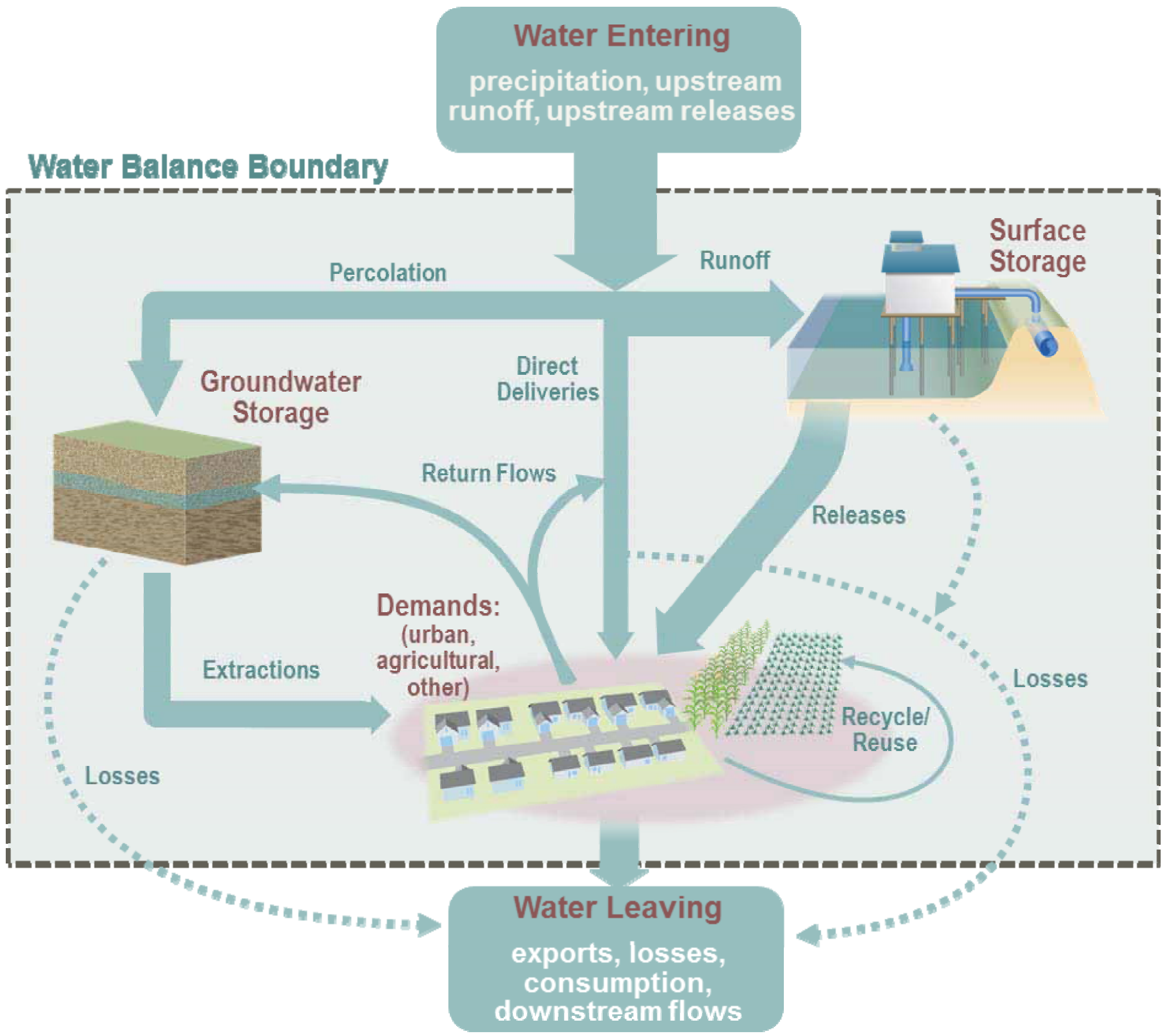


Figure 3-1: Water Balance Schematic

3.1.1.1 Water Entering

Water enters the Region from multiple sources including precipitation (mostly rainfall with some snowfall) and water imported from a number of sources outside the Region boundary. The low-lying valley floor areas receive approximately 18 inches of precipitation on average per year, while the higher elevations in the Coastal mountain range on the western side of the Region can receive more than 70 inches of rain annually. Much of the precipitation that falls within the water balance boundary flows across the landscape into small streams and creeks that enter major lakes and reservoirs. Some percentage of the precipitation percolates into the soil and is consumed by plants or eventually flows into one of the many groundwater aquifers underlying the Region. Some of the precipitation evaporates or flows out of the Region boundary.

Water that enters the Region that did not originate completely from a watershed within the Region is considered an imported water supply. For example, water diverted from the Sacramento River and Delta is considered "imported", even though the Sacramento River and Delta share a common boundary with the eastern boundary of the Westside Region. Imported surface water supplies play an important role in the beneficial activities within the Region. While considerable water supplies originate from the Cache and Putah Creeks watersheds within the Region, local surface and groundwater supplies are not sufficient to meet the extensive agricultural, urban, municipal, and domestic demands for water.

Imported water is acquired through a number of different water rights and contracting mechanisms. Some of the imported water is provided to local agencies from the State of California State Water Project (SWP) operated by DWR, or the United States Bureau of Reclamation's Central Valley Project (CVP). Some key import facilities include the SWP's North Bay Aqueduct (NBA) in Solano County and CVP's Tehama-Colusa Canal in Yolo County. Major infrastructure for importing water into the Region are shown in Figure 3-2.

3.1.1.2 Water within the Region

Once water enters the water balance boundary, most of the runoff from precipitation flows to one of several intermediate surface storage reservoirs in the upper watersheds. Much of the remaining water that doesn't flow into surface storage reservoirs percolates into shallow groundwater aquifers and recharges the groundwater storage or routed directly to be applied to meet an immediate water demand.

3.1.1.2.1 Surface Water

Surface water accounts for approximately 66 percent of the overall water applied for use in the Westside Region in an average year. The major lakes and reservoirs within the Region include Clear Lake, Indian Valley Reservoir, and Lake Berryessa. These lakes and reservoirs provide numerous benefits including water supply, flood protection, hydropower generation, habitat, and recreation. Some of the key facts about the reservoirs are provided in Table 3-1. Some water users divert directly from the lakes and reservoirs, but most surface water used is released downstream. Surface storage within the Region adds resiliency to the water management system that helps to protect against droughts, but in certain cases the available over-year storage is not sufficient to meet the applied water demands over multiple dry years and available supplies are reduced.

Table 3-1: Major Lakes and Reservoirs

Reservoir	Net Usable Capacity (AF)	Dam	Hydroelectric Capacity	Owner of Hydroelectric Power Plant
Indian Valley Reservoir	300,600	Indian Valley Dam	3,000 kW	Yolo County Flood Control & Water Conservation District
Clear Lake	313,000	Cache Creek Dam	1,750 kW*	Yolo County Flood Control & Water Conservation District
Lake Berryessa	1,602,000	Monticello Dam	11.5 MW	Solano Irrigation District

* Not currently in operation

When large rainfall events occur during the winter season, flood releases may be made from the dams into Cache and Putah Creeks, which flow into the lower watershed and ultimately to the Yolo Bypass, Sacramento River and the Sacramento-San Joaquin Delta.

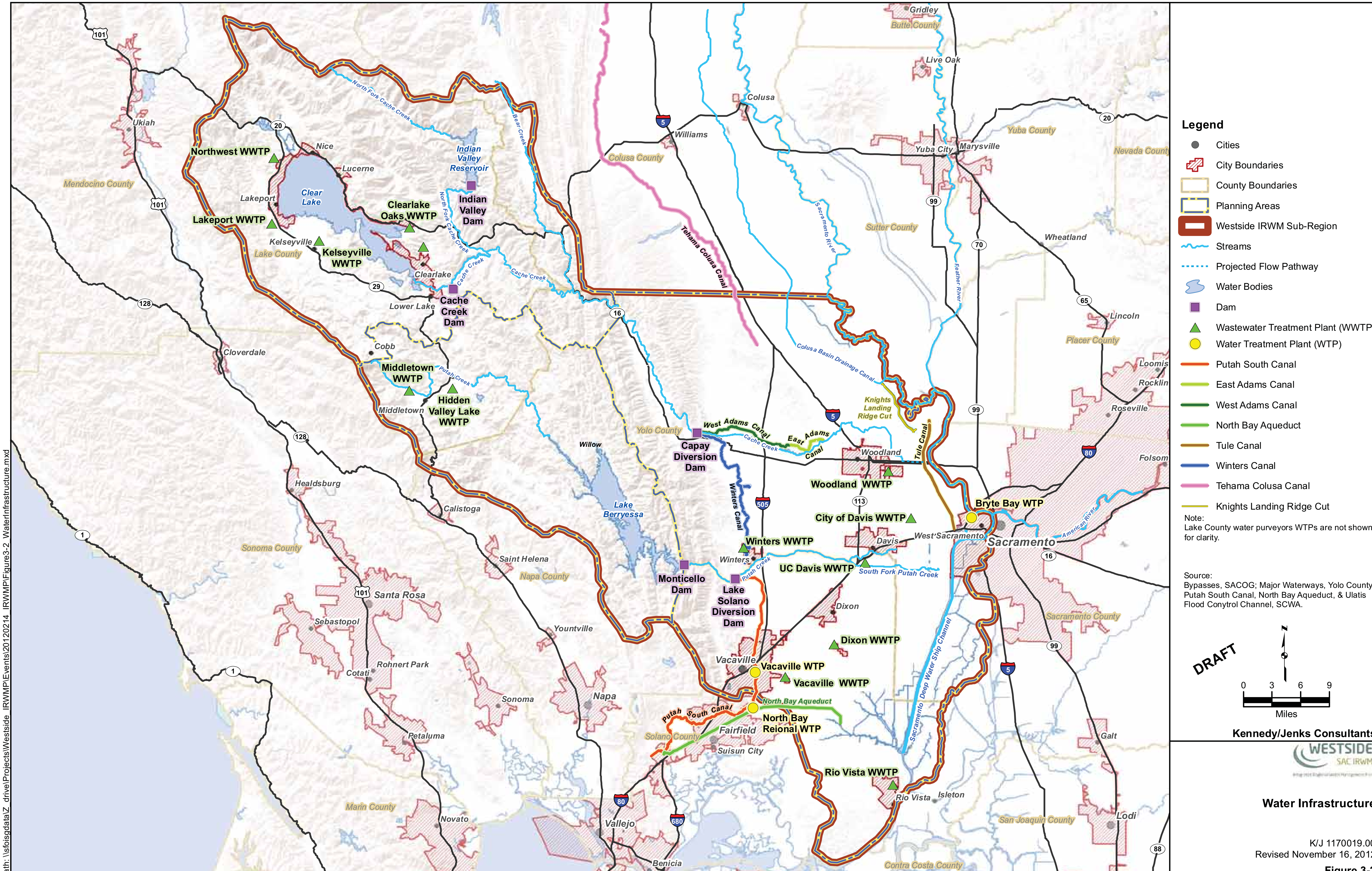
Surface water supplies can be distributed throughout the Region through an intricate network of canals, sloughs, and pipelines to end users. There are over 100 miles of surface water conveyance infrastructure spread throughout the Region. Regional water supply infrastructure is shown in Figure 3-2 and includes facilities such as major diversion structures, canals, surface water treatment plants, and wastewater treatment plants.

Flood protection infrastructure is discussed in Section 3.3.1. Some of the flood protection infrastructure, such as the Yolo Bypass and Ulatis Flood Control System serves multiple purposes and can be used to convey wastewater discharges, water supply, and provide critical habitat.

3.1.1.2.2 Groundwater

Groundwater aquifers also serve as a key source for water supplies in the Region. For many water users, groundwater is the only readily accessible supply source. Thousands of groundwater wells exist within the Region, and most supply individual domestic needs or small agricultural operations. There are also a number of municipal wells that serve some of the larger cities. Davis, Woodland, and Dixon currently rely on groundwater as their sole supply source. Maintenance of sustainable groundwater aquifers that yield high quality groundwater plays an important role in the long-term water balance within the Region.

Fifteen distinct groundwater basins have been identified in the upper Cache Creek and Putah Creek watersheds. Users extract groundwater from these basins primarily from shallow alluvial deposits, fractured sedimentary and metamorphic rock within the Franciscan Formation, and the Clear Lake volcanic deposits. The major groundwater basins used for supply in the upper watersheds include Big Valley, Scotts Valley, and Upper Lake Valley. Significant information exists for the major alluvial aquifers but very little information has been gathered for the fractured bedrock and volcanic aquifers. The geologic and hydrologic characteristics of each groundwater basin differ considerably including the aquifer permeability and material composition, sources of recharge, distribution over area and depth, and presence of boundaries or faults that limit groundwater flow.



Path: \\sfoisgdata\Z_drive\Projects\Westside_IRWMP\Events\20120214_IRWMP\Figure3-2_WaterInfrastructure.mxd

The Valley Floor Planning Area overlies several subbasins of the Sacramento Valley Groundwater Basin, namely the Capay Valley Subbasin, Colusa Subbasin, Yolo Subbasin and Solano Subbasin. The water bearing formations of these basins are essentially contained within two stratigraphic units: (1) the older thick alluvial and river sediments of the Tehama formation, and (2) the younger sediments, floodplain deposits, and stream channel deposits that overlie the Tehama formation.

3.1.1.2.3 Water Demands (Applied Water)

The term "demand" is used in this Plan to represent the quantity of water various water users choose to use for one or more beneficial uses according to the cost required for them to use that water. Economists have demonstrated that demand for water can most accurately be described as a function that relates the quantity of water a user will purchase based on the marginal unit cost of water. However, the information required to estimate specific economic functions of demand within the Region do not exist currently.

Therefore, this Plan presents approximations of water demand using estimates of applied water quantities based on historic information and expected urban trends in lieu of economic demand functions. Users apply water within the Westside Region to meet consumptive and nonconsumptive uses. Consumptive water uses within the Region include municipal and industrial (M&I) applications and agricultural applied water. Nonconsumptive water uses within the Region included hydropower, environmental and recreational flows.

The estimates for applied water include considerations of numerous factors including agricultural acreages, crop types, population, historical applied water data, and hydrologic conditions (water year type). Existing documents and studies documenting the current and projected applied water quantities were used whenever possible. Applied water amounts were calculated for the Planning Area, County, and Urban/Community levels where appropriate and grouped into classifications as data allowed (residential, commercial, agricultural, etc.). Very little data is available for expected future agricultural cropping patterns within the Region so applied water estimates for agriculture were assumed to remain constant through 2035.

Table 3-2 and Table 3-3 contain estimated applied water demands for this year (2012), 2015, and 2035 under average and dry hydrologic conditions, respectively. The expected demands increase in dry years due to increased evaporation and higher transpiration (plant water use) rates. Applied water demand is dominated by agricultural use in the Valley Floor Planning Area, comprising approximately 95% of total demand within the Region in 2010.

Table 3-2: Average Year Applied Water Summary

	Current (AFY)			2015 (AFY)			2035 (AFY)		
Applied Water Category	**Valley Floor PA**	**Upper Cache Creek PA**	**Upper Putah Creek PA**	**Valley Floor PA**	**Upper Cache Creek PA**	**Upper Putah Creek PA**	**Valley Floor PA**	**Upper Cache Creek PA**	**Upper Putah Creek PA**
Agricultural	1,450	31	10	1,450	31	10	1,450	31	10
M&I	69	19	2	80	19	2	103	24	4
Total	**1,519**	**49**	**11**	**1,530**	**50**	**12**	**1,553**	**55**	**13**

Table 3-3: Dry Year Applied Water Summary

	Current (AFY)			2015 (AF)			2035 (AFY)		
Applied Water Category	Valley Floor PA	Upper Cache Creek PA	Upper Putah Creek PA	Valley Floor PA	Upper Cache Creek PA	Upper Putah Creek PA	Valley Floor PA	Upper Cache Creek PA	Upper Putah Creek PA
Agricultural	1,555	41	11	1,555	41	11	1,555	41	11
M&I	69	11	2	80	12	2	103	16	4
Total	**1,624**	**51**	**13**	**1,634**	**52**	**13**	**1,657**	**57**	**15**

Urban water suppliers (with more than 3,000 service connections or delivering more than 3,000 AFY) are required by DWR to prepare UWMPs and are now also required to develop gallon per capita day water use reduction targets in accordance with SBx7-7, the Water Conservation Act of 2009. Table 3-4 presents the baseline GPCD, 2015 Interim Target, and 2020 Compliance Targets that were included in the UWMPs. Please refer to each UWMP for a discussion of the data and calculation methods used to select each GPCD target. Water conservation necessary to meet these GPCD targets is key in the Region since these urban water suppliers represent a significant percentage of the overall M&I water demand.

Table 3-4: UWMP Baseline GPCD Factors

Urban Water Supplier	Baseline (gpcd)	2015 Interim Target	2020 Compliance Target
Vacaville	172	169	166
Rio Vista [(a)]	320	---	256
Davis	203	204	167
Dixon	166	168	164
West Sacramento	305	275	244
Woodland	289	260	231

Rio Vista 2010 UWMP did not include a 2015 Interim Target.

3.1.1.2.4 Recycled/Reuse Flows

Community wastewater collection, treatment, and disposal systems serve larger, more urbanized populations. The majority of domestic wastewater in the Westside Region is treated by onsite individual septic systems. Community wastewater systems influence how water moves within the region and the availability of recycled water. Wastewater which is disposed of within the Region and is not currently consumptively used provides a source of water that could be captured for reuse. Table 3-5 summarizes the current disposal methods for the Region's wastewater treatment plants.

Table 3-5: Wastewater Treatment Plants and Disposal Methods

Planning Area/Facility	Disposal Method
Upper Putah Creek Planning Area	
Hidden Valley Lake WWTP	Land application - golf course
Middletown WWTP	Geothermal injection
Upper Cache Creek Planning Area	
Lakeport WWTF	Land application – pasture
Kelseyville WWTP	Land application – vineyards
Northwest Regional WWTP	Geothermal injection – exported outside Region
Southeast Regional WWTP	Geothermal injection – exported outside Region
Clearlake Oaks WWTP	Geothermal injection – exported outside Region
Valley Floor	
Davis WWTP	Willow Slough Bypass and Conaway Toe Drain (tributaries to or part of Yolo Bypass)
Easterly WWTP (Vacaville)	Alamo Creek (to Cache Slough)
Winters WWTF	Land application - native grasslands
UC Davis WWTP	Putah Creek
Dixon WWTP	Land application - percolation/evaporation basins
Woodland WWTP	Unimproved channel to Tule Canal (Yolo Bypass)
Rio Vista - Beach Drive	Sacramento River
Rio Vista – Northwest	Sacramento River
West Sacramento WWTP	Export to Sacramento Regional County Sanitation District

Sources: Lake County Inventory & Analysis, City of Davis Urban Water Management Plan, City of Vacaville Urban Water Management Plan, Winters Municipal Service Review, UC Davis NPDES No. CA0077895, City of Woodland Urban Water Management Plan, City of Rio Vista Urban Water Management Plan, City of West Sacramento Urban Water Management Plan

Wastewater systems also serve an important function in protecting water bodies from water quality degradation. Understanding the available capacity of wastewater treatment plants in the Lake County area could be beneficial in assessing opportunities to treat additional flows and reduce septic system impacts in the area; additional research on this topic is necessary. There is no recycled water currently produced in the Upper Cache or Putah Planning Areas that is available for local reuse. Most of the wastewater effluent is exported and reused at the Geysers project, which is located in Sonoma County to the west of the planning area boundary.

Wastewater discharges from the nine wastewater treatment plants in the Valley Floor Planning Area provide multiple reuse and water recycling opportunities. Some of the wastewater is discharged to managed wetlands to provide habitat and aquifer recharge benefits (City of Davis), while other wastewater effluent is discharged into local creeks for later reclamation for agricultural use (City of Vacaville Easterly WWTP).

3.1.1.2.5 Return Flows

Return flows include runoff from agricultural irrigation or outside landscape irrigation in developed areas that either reenter the surface water system, or percolate in to recharge the aquifers and are later recoverable. The term “return flow” refers to the part of applied water that is not consumed by evapotranspiration and that migrates to an aquifer or surface water body. For the Westside Region there are three types of return flows: agricultural, urban, and recycle/reuse return flows. Each of these is discussed in more detail in Appendix 3-x. Actual return flows are a function of actual water applied within the study area, the timing of releases, conveyance losses, and the location of diverters downstream relative to the return flow sources. In certain year types, especially drier conditions there may not be enough water available to supply the total projected applied water need. Typically row and field crops in the Region have been fallowed, which would in turn reduce the total available return flows.

3.1.1.3 Water Leaving

Water leaves the Region through a several mechanisms including exports to neighboring Regions, downstream flow to the Sacramento River or Sacramento-San Joaquin Delta, water consumption, and other losses. Water consumption includes the portion of M&I and agricultural applied water that is not returned to the water system. Native vegetation and agricultural crops transpire water which also factors into the overall consumption.

Water loss is a major component of the water balance and also one of the most difficult factors to determine. Losses include plant evapotranspiration, surface water evaporation, and subsurface groundwater flows that leave the Region and are unrecoverable. Evaporative losses occur on the expansive surface area of the three major water bodies, as well as conveyance losses through leaking pipelines and open top irrigation canals and ditches throughout the Region. Some water lost due to seepage from leaking pipelines and canals also percolates into the soil and shallow aquifer and contributes to groundwater recharge. Future versions of the water balance could consider quantified estimates of evaporative losses in the system, losses due to evapotranspiration from irrigation practices, and benefits accrued from groundwater recharge

3.1.2 Water Balance Comparison

The following water balance findings are summarized for the Westside Region and each of the three planning areas. Tabular results for the 2035 planning horizon are provided in Table 3-6 and Table 3-7. Values on the schematics shown as “NQ” mean not-quantified. NQ indicates that the data was not available to complete this component of the water balance. Although it was determined that there is not enough information available to complete a traditional water balance related to supply and demand, the process revealed a number of key observations as follows:

1. Overall, supply and demand are not managed for the Region as a whole. A number of surface water supply sources that amount to about 40% of water applied in an average year, are managed independently within the Region according to existing contracts. The remaining 60% of water applied in an average year is extracted from a number of groundwater aquifers according to the choices and behaviors of thousands of independent groundwater pumpers.

2. The precipitation within the Region can vary considerably from year to year and in different parts of the Region, which affects the watersheds unimpaired flow (upstream runoff). For example, the average annual unimpaired flow in the upper Cache Creek watershed (above Rumsey) is 524 TAF, but has ranged between 62 and 1,964 TAF. The variability and timing in precipitation affects the amount of surface water that is captured and stored within the region, and also affects the amount of water available to recharge the groundwater aquifers.

3. Much of the effects of the water supply variability are managed within in the agricultural sector since they are the largest users of water in the Region. Flexible agricultural crop choices have allowed many agricultural water uses to change their activities in a given year based on their expectation of the water that will be available. As a result, water demand for agriculture within the region is not well understood. Recently, more permanent type crops have been planted that may make it more difficult to respond to the supply variability in the future without experiencing significant financial losses.

Table 3-6: Regional Water Balance Summary – Average Year (2035)

Category	Planning Area Upper Cache	 Upper Putah	 Valley Floor	Total
Water Entering				
Precipitation	693	455	NQ	1,148
Upstream Runoff (upper watershed)	0	0	669	669
Upstream Flow (regulated releases)	0	0	306	306
Imported Water (outside watershed)	0	0	624	624
Total Water Entering	**693**	**455**	**1,599**	**2,747**
Water Balance Boundary				
Direct Deliveries	0	0	944	944
Surface Water Storage				
Surface Storage	1,062	1,103	0	2,165
Local Release Deliveries	25	NQ	0	25
Downstream Releases (see Water Leaving)				
Groundwater Storage				
Intermediate Aquifer	NQ	NQ	NQ	NQ
Deep Aquifer	NQ	NQ	NQ	NQ
Groundwater Percolation (Recharge)	72	14	524	610
Return Flows				
Agricultural RF	8	2	362	373
Urban RF	2	0.5	15	18
Wastewater RF	0.4	0.1	3	4
Total Return Flows	10	3	381	394
Recycle/Reuse	1	0.4	21	23
Total Water Supplies	**119**	**NQ**	**1,869**	**1,988**
Applied Water				
Applied Surface Water				
M&I	13	0.7	103	116
Agricultural	6	8	986	1,000
Total Surface Water Use	19	8	1,089	1,116
Applied Groundwater Extractions				
M&I	3	3	63	69
Agricultural	25	2	464	491
Total Groundwater Extractions	28	5	527	560
Total Applied Water	**47**	**13**	**1,616**	**1,676**
Water Leaving				
Consumption of Applied Water	35	10	1,214	1,258
Exports	8	0	56	64
Downstream Releases	153	153	0	306
Downstream Runoff	444	225	199	868
Wastewater Discharges	4	0.1	10	14
Losses				
Surface Evaporation/Seepage	NQ	102	NQ	102
Subsurface Aquifer	NQ	NQ	NQ	NQ
Other Unrecoverable Losses	NQ	NQ	NQ	NQ
Total Water Leaving	**644**	**491**	**NQ**	**1,135**

* NQ -Not Quantified

Table 3-7: Regional Water Balance Summary – Dry Year (2035)

Category	Planning Area Upper Cache	Upper Putah	Valley Floor	Total
Water Entering				
Precipitation	218	123	NQ	341
Upstream Runoff (upper watershed)	0	0	274	274
Upstream Flow (regulated releases)	0	0	236	236
Imported Water (outside watershed)	0	0	367	367
Total Water Entering	**218**	**123**	**877**	**1,218**
Water Balance Boundary				
Direct Deliveries	0	0	606	606
Surface Water Storage				
Surface Storage	935	965	0	1,900
Local Release Deliveries	25	NQ	0	25
Downstream Releases (see Water Leaving)				
Groundwater Storage				
Intermediate Aquifer	NQ	NQ	NQ	NQ
Deep Aquifer	NQ	NQ	NQ	NQ
Groundwater Percolation (Recharge)	72	14	524	610
Return Flows				
Agricultural RF	10	3	389	402
Urban RF	2	0.5	15	18
Wastewater RF	0.4	0.1	3	4
Total Return Flows	13	3	407	423
Recycle/Reuse	1	0.4	21	23
Total Water Supplies	**99**	**NQ**	**1,558**	**1,657**
Applied Water				
Applied Surface Water				
M&I	13	0.7	103	116
Agricultural	8	9	902	919
Total Surface Water Use	21	10	1,004	1,035
Applied Groundwater Extractions				
M&I	3	3	63	69
Agricultural	33	2	653	688
Total Groundwater Extractions	36	5	716	757
Total Applied Water	**57**	**15**	**1,720**	**1,792**
Water Leaving				
Consumption of Applied Water	43	11	1,292	1,346
Exports	0	0	56	56
Downstream Releases	84	152	0	236
Downstream Runoff	166	108	199	473
Wastewater Discharges	4	0.1	10	14
Losses				
Surface Evaporation/Seepage	NQ	102	NQ	102
Subsurface Aquifer	NQ	NQ	NQ	NQ
Other Unrecoverable Losses	NQ	NQ	NQ	NQ
Total Water Leaving	**297**	**374**	**NQ**	**670**

* NQ -Not Quantified

4. Many areas throughout the Region have access to both groundwater and surface water supplies which provides a desirable level of flexibility. However, there are some areas, including communities surrounding Clear Lake and the major cities in Yolo County (Woodland and Davis) that are reliant upon a single source of supply and may experience shortages during dry periods. There are also significant areas of agricultural practice that rely on a single source of water and can experience considerable variability each year as a result.

5. Climate change impacts on water supplies are still being determined, but will likely result in increased variability in temperature, annual precipitation and surface water runoff and changes in the timing and frequency of storms that affect the ability to store water for agricultural or municipal uses. These changes could lead to less groundwater recharge and more frequent and increased use of groundwater within the Region. Increased use and reduced availability of groundwater could negatively impact areas that depend on groundwater for their supply.

6. Some groundwater aquifers contain high concentrations of constituents that produce water with a quality that may not be suitable for all beneficial uses (either for direct use, or because of water quality concerns related to wastewater discharge).

7. Much of the data needed to complete a full water balance projection for various hydrologic conditions is not readily available. As shown in the figures there are number of items not quantified (NQ), and there is a low confidence level regarding many of the data sources. The most significant factor that is NQ is projected agricultural demand. There is also considerable uncertainty about groundwater recharge and storage which is heavily used to adapt to changing availability of surface water.

3.1.3 Upper Watersheds Water Balance

All of the water entering the Upper Cache and Upper Putah creek watersheds arrives in the form of rain or snowfall. The unpredictability of rainfall results in wide fluctuations of runoff each year; the estimated water entering the upper watersheds is approximately 1,150 TAF on average, and 341 TAF in a dry year. Figures 3-3 through 3-6 show the water balances for the Upper Cache and Upper Putah Planning Areas in the average and dry hydrologic years. Most of this water is captured in one of the three reservoirs and is eventually released, flowing downstream leaving the planning areas and entering the Valley Floor PA. Local water users within the Upper Cache and Upper Putah Planning areas primarily draw their supplies from the lakes and reservoirs, and groundwater. There are also some riparian diversions from the streams and creeks. Most of the water that enters the upper watersheds is either stored and then released downstream into Putah and Cache Creeks, or lost to surface evaporation on the lakes.

The following list presents the key findings of the water balance comparisons:

1. Most purveyors around Clear Lake receive surface water from the lake via contract with YCFCWCD. YCFCWCD is committed to ensure this supply is available to Clear Lake customers in all hydrologic year types.

2. Water supply and/or infrastructure limitations have resulted in an inability to get building permits in several areas around Clear Lake. Three County Service Areas and two private purveyors have or recently had moratoriums on new service connections.

3. Approximately 80 percent (28 TAF per year) of agricultural water is supplied by groundwater. However, the sustainable yield of the ten groundwater basins in the planning area is not well understood. Studies have indicated that a 10 year or more return interval drought condition could cause a groundwater shortage (1987 Lake County Resources Management Plan per Tom Smythe), although the specific conditions that would cause this scenario have not been confirmed.

4. There appears to be a potential for supply shortages for M&I and agricultural uses in the future. More detailed analysis of the expected supplies and demands under prolonged drought conditions for this Planning Area may be worthwhile.

5. The water users within the Upper Putah Planning Area are mostly rural and self-supplied. These rural users rely predominantly on groundwater. There is no indication that the groundwater supplies have not been sufficient to date.

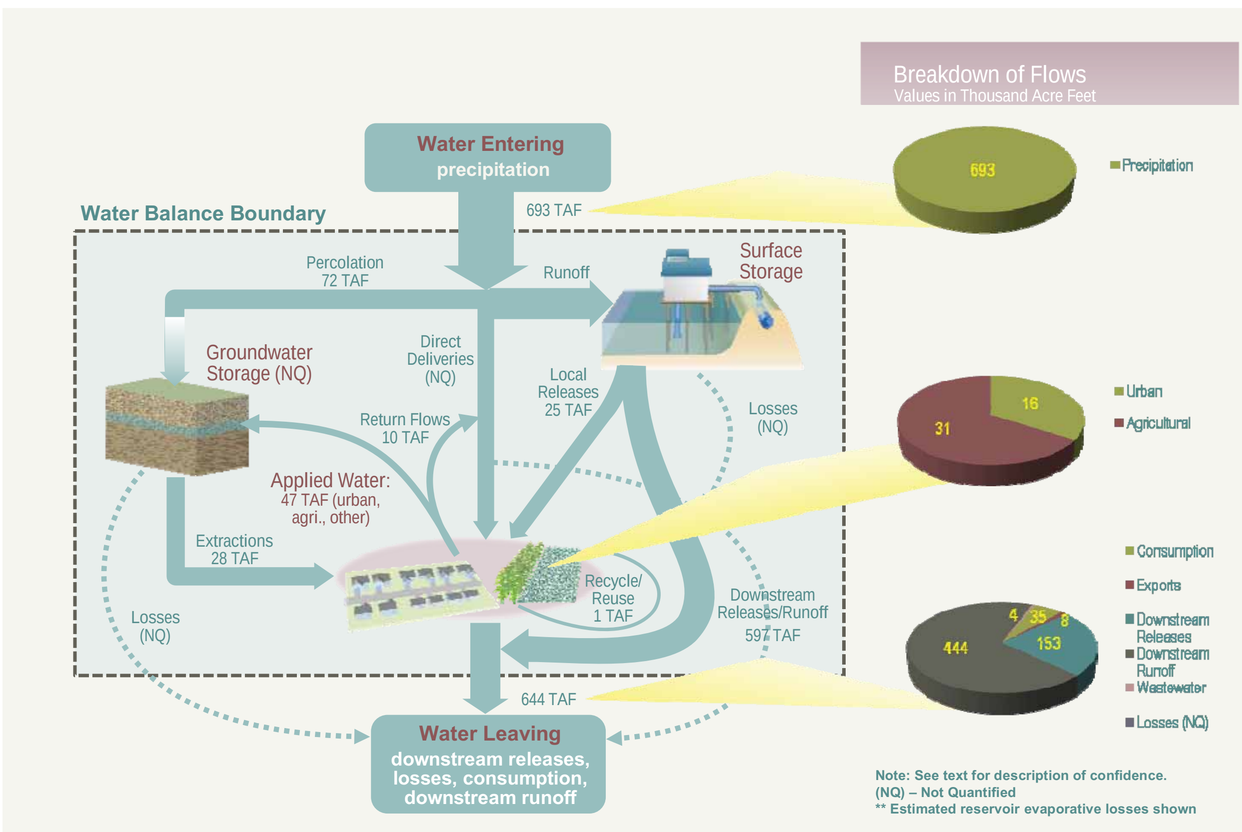


Figure 3-3: Average Year – Upper Cache Planning Area

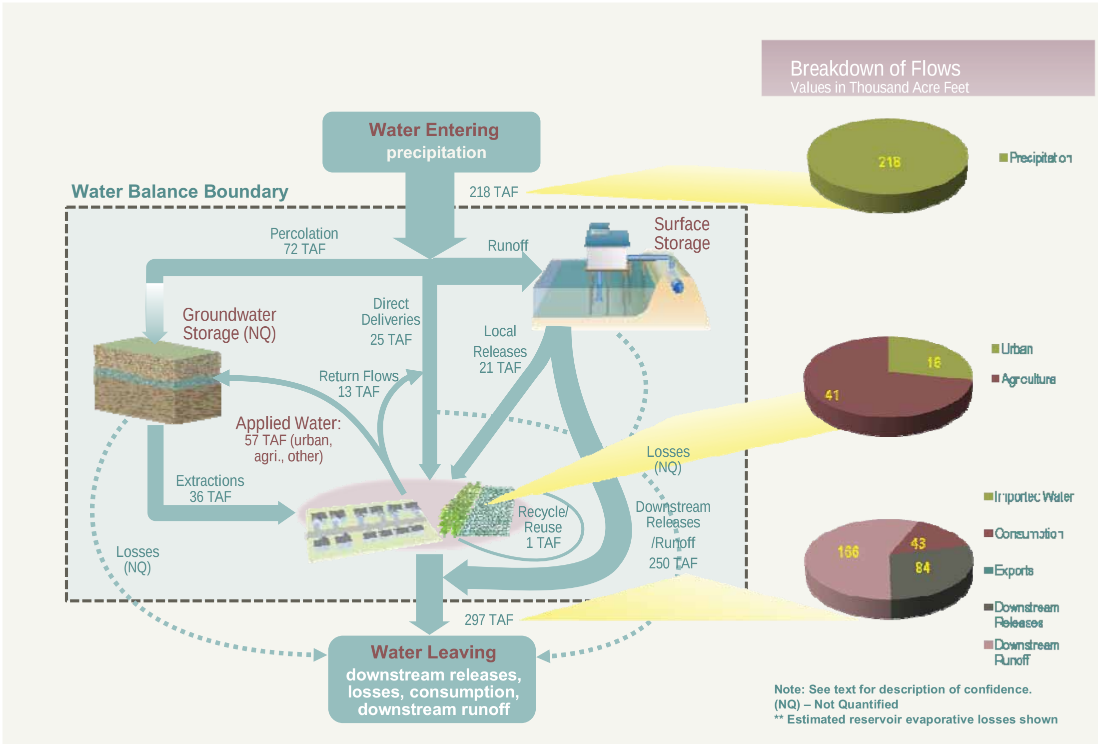


Figure 3-4: Dry Year – Upper Cache Planning Area

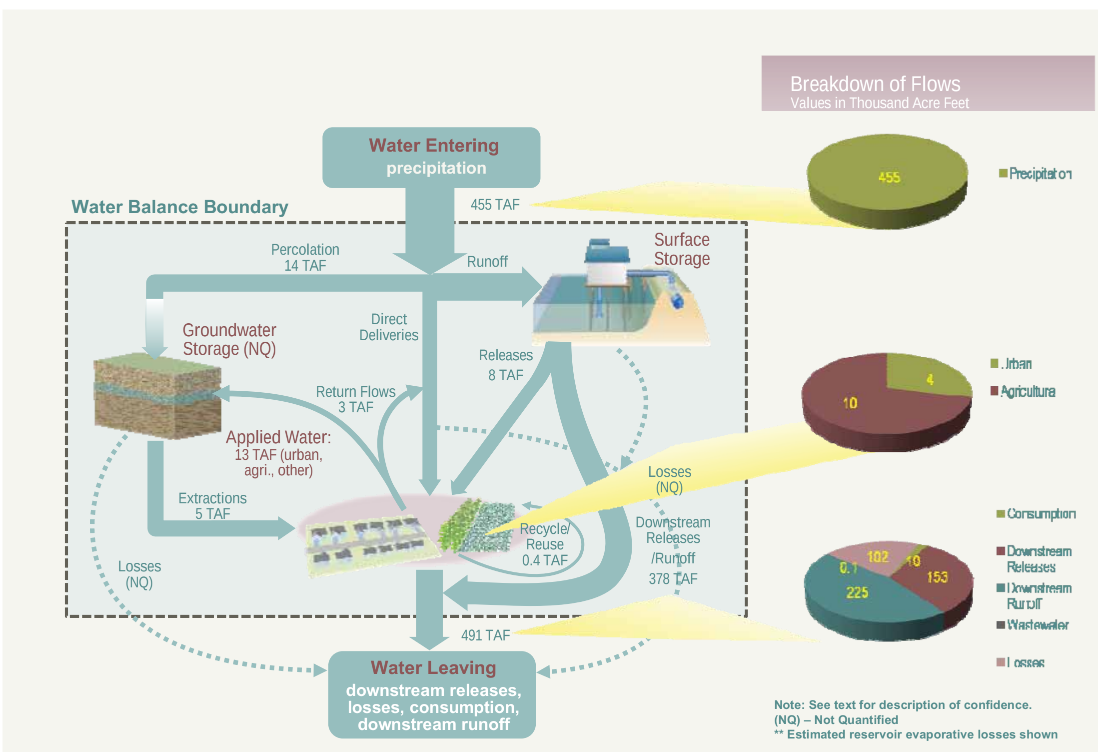


Figure 3-5: Average Year – Upper Cache Planning Area

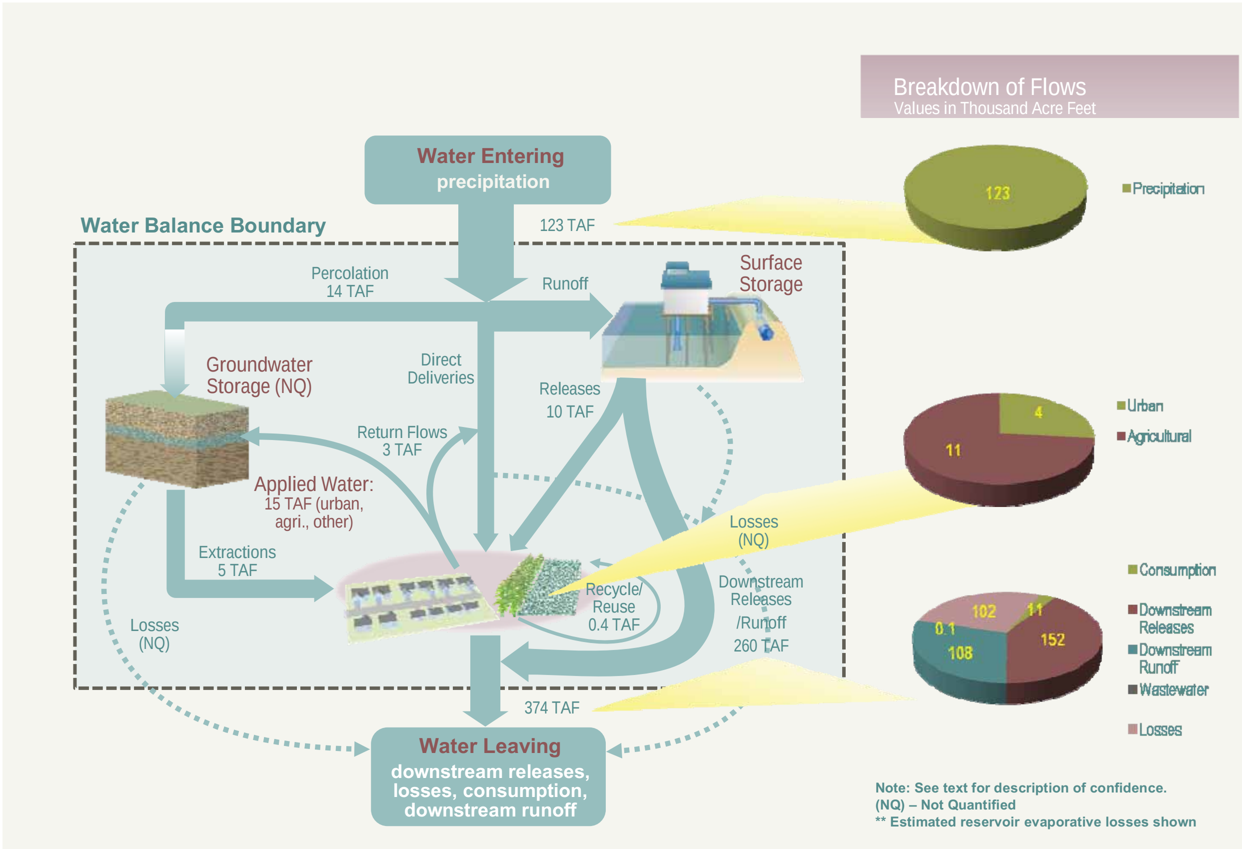


Figure 3-6: Dry Year – Upper Putah Planning Area

3.1.4 Valley Floor Water Balance

The Valley Floor PA water balance is provided in Figure 3-7 and Figure 3-8. Water is supplied to the Valley Floor PA from many different sources including both upper watersheds, groundwater pumping, and extensive imported water infrastructure. Part of the reason for this is the fact that there are no major reservoirs in this generally flat-lying area. The water balance schematic shows balancing reservoirs instead of surface storage. Balancing reservoirs include the water impounded by YCFCWCD's Capay Dam and SCWA's Solano Diversion Dam.

It is estimated that there is over 1,600 TAF of applied water demand in the Valley Floor PA in an average year.

The following list presents the key findings of the water balance comparisons for the Valley Floor PA:

1. There is insufficient information to determine whether there is adequate future water supply because the water system is self-adapting. The trend towards permanent agricultural crops may change the adaptability in the future, but there is not enough information available right now to know whether that is true.

2. Demand for applied water in the planning area is dominated by agricultural uses. Recent trends have been towards more permanent crops such as vineyards and olives, which may over time, contribute to demand hardening and changes in irrigation patterns. At present, approximately 15 percent of all crops are permanent type. Region specific agricultural projections are not currently available, but may be available in the near future as part of the California Water Plan 2013 Update.

3. Municipalities and agricultural groundwater users will be able to make better long term water management decisions with an increased understanding of the sustainable yield of shallow and deep aquifers in the Capay, Yolo, and Colusa subbasins. Additional information is especially needed to estimate the safe yield of deep Tehama formation serving many of the larger urban areas (City of Davis, UC Davis, Woodland, and Vacaville). Characterization of specific localized groundwater supply reliability will help ensure this resource is used sustainably.

4. Municipal recycled water use is currently negligible and is projected to account for about 1% of the water supply in the Valley Floor PA by 2020. Required upgrades to existing wastewater treatment plants such as the Cities of Vacaville and Davis could make additional recycled water available for agricultural or domestic reuse if it is found to be locally cost-effective.

5. There is an imbalance in the availability of surface water across different parts of the Valley Floor. For example, some purveyors in northern Yolo County have no or limited access to surface water, especially during dry periods. There may be an opportunity for purveyors to share resources to a greater extent across the Region in the future. Areas within the PA that could benefit from improved water movement/conjunctive use such as: Cities of Davis and Woodland, Portions of northern Yolo County that do not have access to surface water, such as Yolo-Zamora Water District, and other agricultural water users in Yolo and Solano Counties that do not have access to multiple supply sources

6. Solano County and each of its retail water agencies expects to meet 100% of expected demand through the planning period, based on contracted amounts. Several other agencies, such as the City of West Sacramento also anticipates meeting 100% of expected demand.

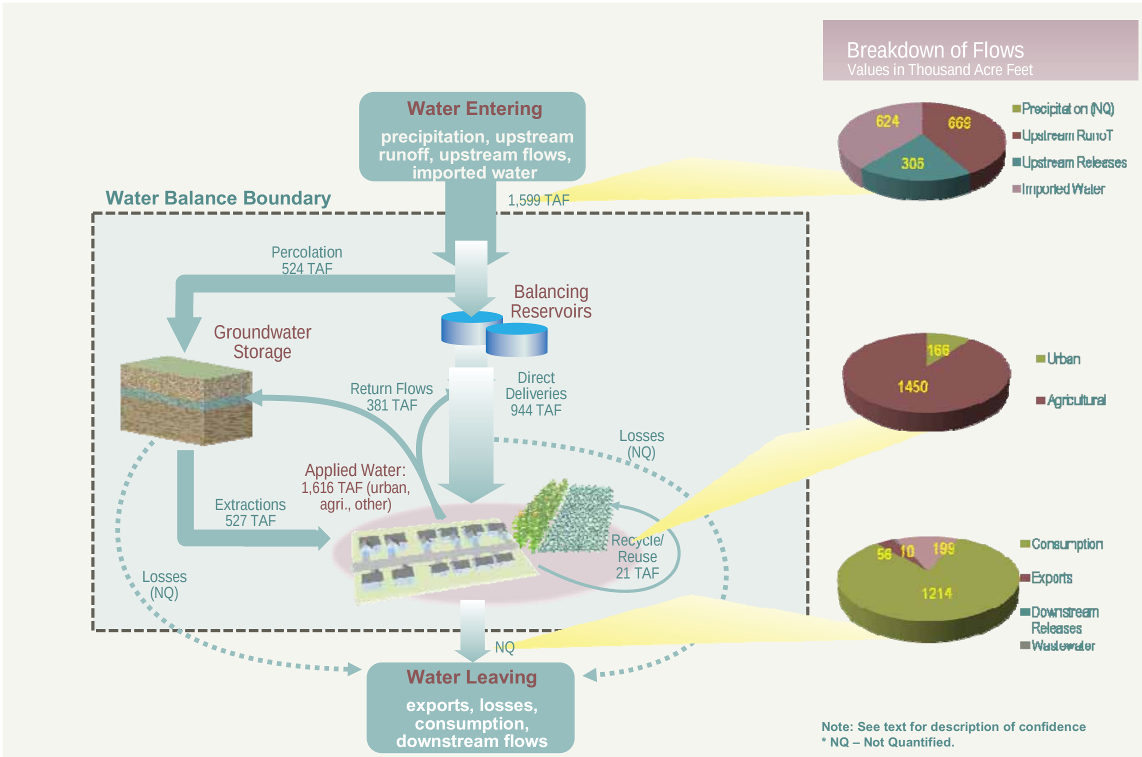


Figure 3-7: Average Year – Valley Floor Planning Area

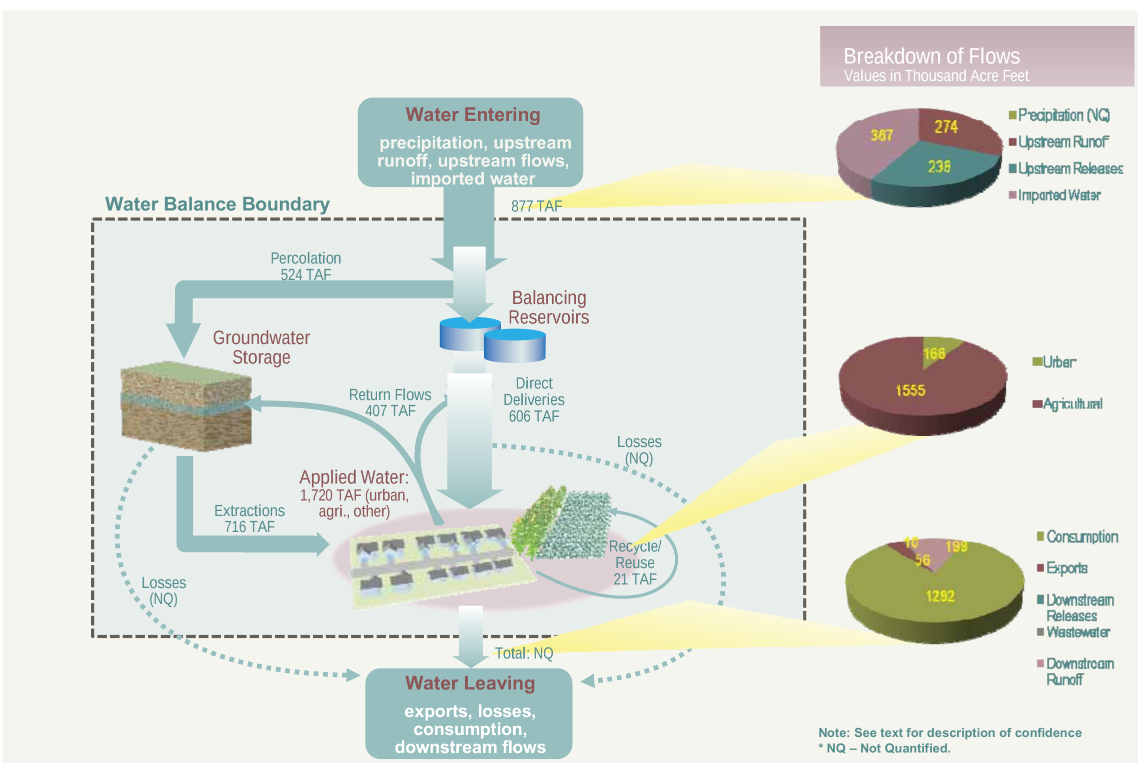


Figure 3-8: Dry Year – Valley Floor Planning Area