



# Water Conservation Plan and Water Use Efficiency Goals

November 1, 2007

## **CHAPTER 3**

### **DEMANDS FOR WATER**

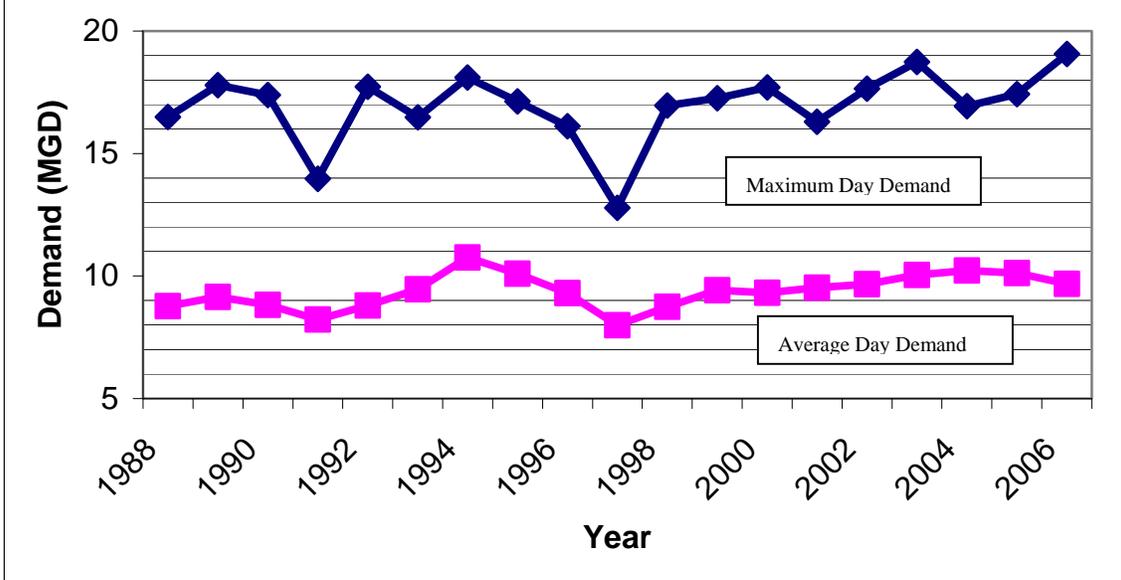
#### **3.1 EXISTING DEMANDS FOR WATER**

Table 3-1 shows the annual water production values for 1994 - 2006. The Average Day Demand (ADD) and the Maximum Day Demand (MDD) are based on total water production and therefore include all accounted for or unaccounted for. Figure 3-1 shows the fluctuation in Average Day Demand and Maximum Day Demand over the same time period. The total water production for 1994 was 3,757 MG, (11,534 ac-ft), an all-time high. 1994's annual production corresponds to an ADD of 10.29 MGD. The Maximum Day Demand recorded during 1994 was 18.28 MGD, however, the highest Maximum Day Demand was 19.07 MGD in 2006. Demand for water in the service area follows an expected seasonal pattern of summer highs and winter lows, increasing during the growing season as those customers without access to supplemental irrigation water utilize City water. Figure 3-2 illustrates the seasonal variation in water production for between 1994 and 2006. Year-to-year fluctuations in total water demand may be attributable to variations in annual precipitation rates, and temperature variations.

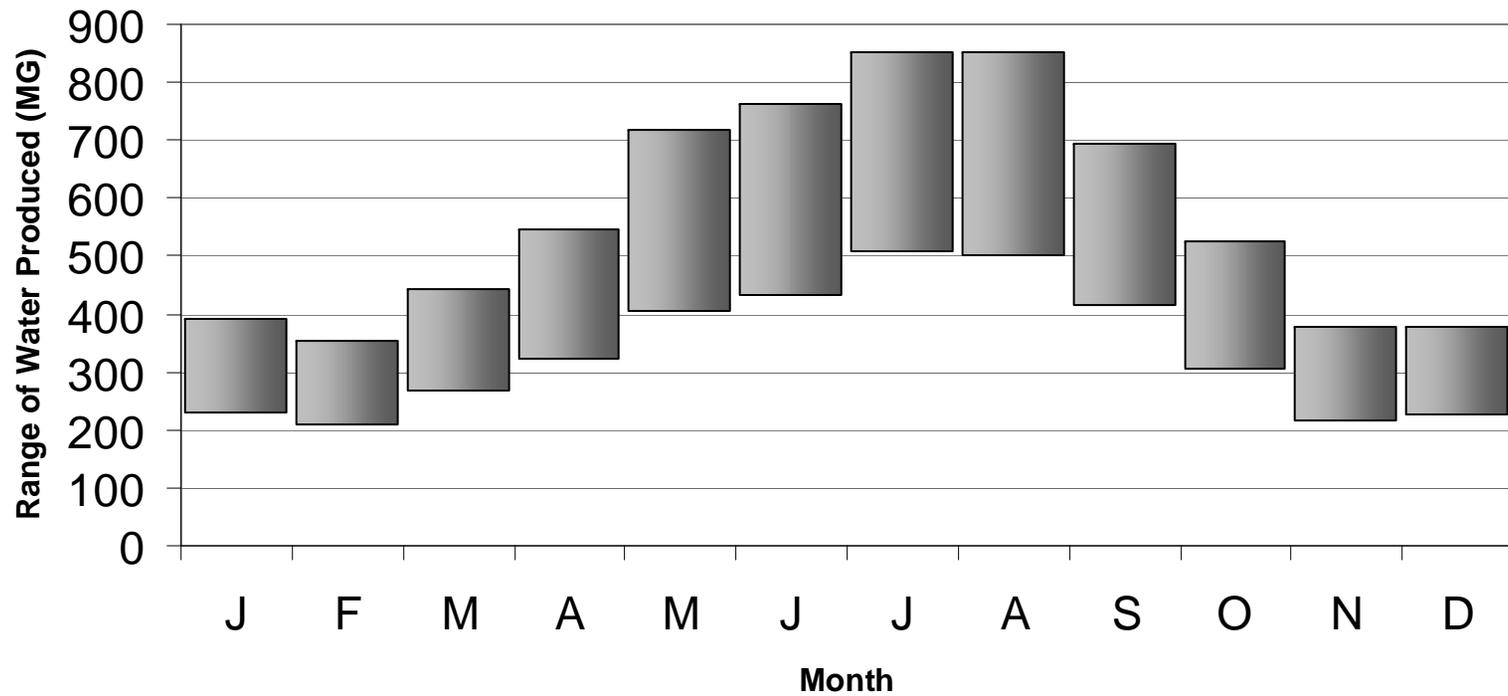
**Table 3-1  
City of Kennewick  
Total Annual Water Production**

Year	Total Water Produced (MG)	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peaking Factor
1994	3757	10.29	18.28	1.78
1995	3684	10.09	17.13	1.70
1996	3405	9.30	16.12	1.73
1997	2870	7.86	12.78	1.63
1998	3189	8.74	16.96	1.94
1999	3437	9.42	17.26	1.83
2000	3406	9.31	17.70	1.90
2001	3483	9.54	16.29	1.71
2002	3538	9.69	17.65	1.82
2003	3674	10.07	18.74	1.86
2004	3739	10.22	16.93	1.66
2005	3704	10.15	17.74	1.75
2006	3541	9.70	19.07	1.97

**Figure 3-1  
City of Kennewick Water System  
Average and Maximum Day Demands**



**Figure 3-2**  
**City of Kennewick Water System**  
**1988 - 2006 Monthly Water Production Range**



The monthly average daily demands for the summer months of June through August were compared to the monthly average daily demands for the winter months of January through March, November and December and are shown in Table 3-2.

<b>Table 3-2 City of Kennewick Seasonal Water Demands</b>			
<b>Year</b>	<b>Average Day Demand (mgd)</b>	<b>Winter Month Demand Jan. - Mar. Nov. - Dec. (mgd)</b>	<b>Summer Month Demand Jun. - Aug. (mgd)</b>
1994	10.29	7.02	15.66
1995	10.09	7.13	13.91
1996	9.30	6.14	14.00
1997	7.86	5.27	11.14
1998	8.74	5.67	13.04
1999	9.42	6.14	13.67
2000	9.31	6.16	13.66
2001	9.54	6.41	13.76
2002	9.69	6.43	13.86
2003	10.07	6.52	14.93
2004	10.22	6.76	14.64
2005	10.15	6.87	15.05
2006	9.70	6.29	14.55
AVG.	9.57	6.37	13.99

Per capita water demands were developed based on the estimated populations for the service area for the period from 1994 through 2006. These were determined for average annual demand, winter demand, and summer demand and are shown on Table 3-3.

**Table 3-3  
City of Kennewick  
Per Capita Water Demand (1994 – 2006)**

<b>Year</b>	<b>Population</b>	<b>Annual Average Per Capita Demand (gpcd)</b>	<b>Winter Month Per Capita Demand Jan. - Mar., Nov. - Dec. (gpcd)</b>	<b>Summer Month Per Capita Demand Jun. - Aug. (gpcd)</b>
1994	55,274	186	127	283
1995	56,419	179	126	247
1996	56,358	165	109	248
1997	57,649	136	91	193
1998	58,763	149	96	222
1999	59,498	158	103	230
2000	60,780	155	102	227
2001	61,130	156	105	225
2002	61,709	157	104	225
2003	63,415	159	103	235
2004	64,144	159	105	228
2005	65,744	154	104	229
2006	67,143	144	94	217
AVG		158	105	231

A comparison of average winter month demands to summer demands (105 gpcd to 231 gpcd) shows the impact of activities such as irrigation, seasonal industrial usage, car washing, construction projects, and fire hydrant flushing. Summer per capita demands are more than twice the winter demands.

A review of the per capita winter month water demand shows a fairly stable unit demand ranging from a low of 91 to a high of 127 gallons per capita per day. The average for the period is 105 gallons per capita per day. This per capita demand includes non-domestic uses including commercial and industrial usage in addition to unaccounted for water such as water loss due to leaks in the system.

### **3.2 DEMAND CATEGORIES**

Table 3-4 lists the numbers of active water service accounts in various categories for the period from 1994 through 2006. Water system demands are categorized as single-family residential, multi-family residential, commercial, and municipal for both In-City and Out-of-City. The City's utility billing database provides information regarding the number of connections in each category. In 2006, there were a total of 17,064 single-family residential connections, 1,189 multi-family residential connections, 1,821 commercial connections, and 144 municipal connections. Total In-City connections numbered 18,288, while Out-of-City connections totaled 1,786.

**Table 3-4  
City of Kennewick  
Active Water System Accounts  
1994 - 2006**

Type of Account	Number of Accounts												
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<i>Residential</i>													
Single													
In City	11,068	11,136	11,272	11,476	11,644	12,723	12,970	13,251	13,646	13,918	14,407	15,019	15,330
Out of City	2,607	2,612	2,624	2,616	2,635	1,690	1,993	2,006	2,042	2,082	1,938	1,728	1,734
Subtotal Accounts	13,675	13,748	13,896	14,092	14,279	14,413	14,963	15,257	15,688	16,000	16,345	16,747	17,064
Multi-Family													
In City	956	1032	1046	1054	1050	1061	1061	1,062	1,062	1,096	1,110	1,148	1,145
Out of City	75	73	69	67	67	54	55	52	52	50	51	44	44
Subtotal Accounts	1,031	1,105	1,115	1,121	1,117	1,115	1,116	1,114	1,115	1,146	1,161	1,192	1,189
<i>Commercial</i>													
In City	1,242	1,268	1,315	1,351	1,404	1,448	1,466	1,556	1,556	1,655	1,713	1,764	1,813
Out of City	20	18	16	16	14	9	9	7	7	10	9	8	8
Subtotal Accounts	1,262	1,286	1,331	1,367	1,416	1,457	1,475	1,563	1,615	1,665	1,722	1,772	1,821
<i>Municipal Accounts</i>	83	84	94	94	92	92	92	98	109	116	117	133	144
<b>TOTAL ACCOUNTS</b>	<b>16,051</b>	<b>16,223</b>	<b>16,436</b>	<b>16,674</b>	<b>16,903</b>	<b>17,077</b>	<b>17,646</b>	<b>18,032</b>	<b>18,474</b>	<b>18,927</b>	<b>19,345</b>	<b>19,844</b>	<b>20,218</b>

### 3.3 WATER DEMAND FORECAST

As the City's population grows and commercial/industrial development occurs, demands on the water system will increase accordingly. Diversification of the Tri-Cities area through a collaboration of efforts by State and local government agencies to secure industrial development has the greatest potential to impact the demand for water for the region. Long-range water demand forecasts were developed as part of the Regional Water Supply Plan (Regional Plan) in June 2000. The Cities of Kennewick, Richland, Pasco, and West Richland collaboratively prepared the Regional Plan in an effort to integrate their individual Water System Plans into a long-term regional water supply program.

The demand forecasts presented in this plan use current production and consumption data and carry forward the commercial/industrial development assumptions that were estimated in the Regional Plan. The major industrial components that are anticipated will likely include food processing industries, research and development, and high technology companies. These types of industries tend to have high water requirements, ranging from 100,000 to well over 1,000,000 gallons per day. The major industrial average daily demands, which have been assumed in the demand calculations included in this plan, are identified in the following tables. Since the location and magnitude of usage for these demands are not known, the major industrial demands identified in this chapter have not been used in the evaluation of specific water system components such as water mains, booster stations, and water reservoirs. These specific infrastructure improvements will be addressed once the major industrial user has been identified and has made a commitment to the area.

To ensure a thorough long-range planning effort, four approaches to water demand forecasting are presented in this plan.

***Equivalent Residential Unit Forecast:*** Equivalent Residential Units (ERUs) are defined by the Washington State Department of Health as “the amount of water consumed by a typical full-time single family residence”. Kennewick calculates these values by dividing the projected annual single-family consumption by the number of projected single-family residential connections. This provides an Average Day Demand (ADD) per single-family residence. Dividing the projected annual single-family consumption by the projected ADD

provides the projected number of ERUs used by the City for one, six, and twenty years into the future. Table 3-5 provides the data for projecting ERUs.

<b>Table 3-5</b> <b>City of Kennewick</b> <b>Equivalent Residential Unit Calculation Data</b>				
	2008	2009	2015	2029
Single-Family Consumption - MG	1,664	1,685	1,819	2,159
Single-Family Connections	26,491	26,831	28,963	34,372
Gal. Per Single-Family Connection	62,813	62,782	62,787	62,798
<b>One ERU = ADD/ERU - Gallons</b>	<b>172</b>	<b>172</b>	<b>172</b>	<b>172</b>
MDD/ERU – Gallons	326	327	327	327
<b>Total Equivalent Residential Units - ERUs</b>	<b>52,982</b>	<b>53,662</b>	<b>57,926</b>	<b>68,744</b>
Maximum ERU Capacity – 30 MGD Max. Production	104,882	104,647	104,640	104,621
Multi-Family Consumption - MG	633	641	692	821
Multi-Family Connections	1,149	1,164	1,256	1,490
Gal. Per Multi-Family Connection	551,049	551,049	551,049	551,049
ADD/ERU - Gallons	480	474	439	370
<b>Multi-Family Factor</b>	<b>2.80</b>	<b>2.75</b>	<b>2.55</b>	<b>2.15</b>
Non-Residential Consumption - MG	1,190	1,206	1,306	1,545
Non-Residential Connections	309	313	339	401
Gal. Per Non-Residential Connection	3,853,443	3,853,443	3,853,443	3,853,443
ADD/ERU - Gallons	10,529	10,557	10,557	10,557
<b>Non-Residential Factor</b>	<b>61.35</b>	<b>61.38</b>	<b>61.37</b>	<b>61.36</b>

into the future, including adding in major industrial demand forecasts discussed earlier.

Year	Projected Population	Single-Family (mgd)	Multi-Family (mgd)	Comm./ Indust. (mgd)	Major Indust. (mgd)	Municipal (mgd)	Unmetered/ Unaccounted for water	Avg. Day Demand (mgd)	Max. Day Demand (mgd)
2008	68,877	4.55	0.55	3.25	0.00	0.53	0.94	9.82	18.66
2009	69,760	4.62	0.55	3.30	0.00	0.54	0.95	9.96	18.92
2015	75,304	4.98	0.55	3.58	2.00	0.58	1.02	12.72	24.17
2029	89,367	5.91	0.55	4.23	5.00	0.69	1.22	17.60	33.45

**Zoning Category Based Demand Forecast:** Historical water demands were further evaluated to determine unit demands to be used in the development of future demands and in assignment of demands to the hydraulic model.

A database was established which included water consumption information for each of the zoning categories. This included eight categories for residential demand. A key factor in identification of unit demands was whether or not irrigation service was provided to the customer from an irrigation district since this has a major impact on summer demands. Commercial, industrial, schools, and public facilities demands were determined based on gallons per day per acre of the total site area. Park demands were based on gallons per day per acre. Unit demands for the winter and summer period used for the forecast model are summarized in Table 3-7.

Zoning Category (1)	Description	Population Per Lot	GPCD Winter	GPCD w/Irrigation (3)	GPCD w/o Irrigation (4)	Acres of Zoning Category	Peak Demand per Acre
SFR1	Single Family <1 AC	2.2	80	102	106	8369.4	234 gpd
SFR2	Single Family >1 AC	2.2	80	102	106	2274.0	234 gpd
MF2	Multi-Family Duplex	3.2	45	50	52	262.6	166 gpd
MF3	Multi-Family Triplex	4.8	45	50	52	21.7	248 gpd
MF4	Multi-Family Quadraplex	6.4	45	50	52	79.0	331 gpd
MF5	Multi-Family >4 Units	8	45	50	52	720.7	414 gpd
MH1	Mobile Home Single Unit	2.2	80	102	106	248.9	234 gpd
MHP	Mobile Home Park	11	45	50	52	649.8	569 gpd
COM	Commercial	gpd/ac (2)	800	1024	1064	1070.0	1064 gpd
IND	Industrial	gpd/ac	1700	2176	2261	265.6	2261 gpd
SCH	School	gpd/ac	150	192	200	354.5	200 gpd
PRK	Park	gpd/ac	325	416	432	744.2	432 gpd
PF	Public Facility	gpd/ac	100	128	133	144.9	133 gpd

(1) Per City of Kennewick Land Use Plan  
(2) gpd/ac: gallons per day per acre  
(3) With irrigation service from an irrigation district  
(4) Without irrigation service from an irrigation district

These unit demands were input into the water system model to develop future demands. This model develops loads based on land and projected growth. The projected demands obtained from this model along with estimated future major industrial demands are summarized in Table 3-8.

**Table 3-8  
City of Kennewick  
Zoning Category Based Demand Forecast**

Year	Projected Population	Single-Family (mgd)	Multi-Family (mgd)	Comm./ Indust. (mgd)	Major Indust. (mgd)	Municipal (mgd)	Unmetered/ Unaccounted for water	Avg. Day Demand (mgd)	Max. Day Demand (mgd)
2008	68,877	4.61	1.80	2.67	0.00	0.57	1.02	10.68	18.58
2009	69,760	4.66	1.83	2.71	0.00	0.58	1.03	10.81	18.82
2015	75,304	5.04	1.97	2.92	2.00	0.63	1.12	13.67	23.79
2029	89,367	5.98	2.34	3.47	5.00	0.74	1.32	18.85	32.80

**Population Based Demand Forecast:** Historical population growth, annual average per capita demand, and demand category information are evaluated in this forecast. The historical annual average per capita demand and individual category usage for years 2004, 2005, and 2006 was used to determine an average per capita demand of 152 gallons and average daily production distribution of 43.45 percent for Single-Family, 16.53 percent for Multi-Family, 26.00 percent for Commercial/Industrial, 5.09 percent for Municipal, and 8.93 percent for Unmetered/Unaccounted for Water. The projected demands obtained from this analysis along with estimated major industrial demands are summarized in Table 3-9.

Year	Projected Population	Single-Family (mgd)	Multi-Family (mgd)	Comm./ Indust. (mgd)	Major Indust. (mgd)	Municipal (mgd)	Unmetered/ Unaccounted for water	Avg. Day Demand (mgd)	Max. Day Demand (mgd)
2008	68,877	4.56	1.73	2.73	0.00	0.53	0.94	10.49	18.78
2009	69,760	4.62	1.75	2.76	0.00	0.54	0.95	10.62	19.02
2015	75,304	4.99	1.90	2.98	2.00	0.58	1.02	13.47	24.11
2029	89,367	5.91	2.25	3.54	5.00	0.69	1.22	18.61	33.31

**Connection Based Demand Forecast:** This method of demand forecasting is very similar to the previous method but utilizes a projection of the number of service connections. Historical water usage information for the years 2004 through 2006 was evaluated to

determine per connection usage, which resulted in a daily average usage of 261 gallons per Single-Family connection, 1,404 gallons for Multi-Family, 1,472 gallons for Commercial/Industrial, and 3,894 gallons for Municipal. The daily average for Unmetered/Unaccounted for Water for this same period was 896,301 gallons. Per connection usages were then applied to the total number of connections that were projected using population growth rate estimates of 1.28 percent through the year 2015 and 1.1 percent per year through 2029. Unmetered/Unaccounted for Water was estimated by increasing the volume of water in this category for the years 2004 through 2006 by the projected population growth rates. The projected demands obtained from this analysis along with the major industrial demands are summarized in Tables 3-10 and 3-11.

Year	Projected Population	Single-Family Conn.	Multi-Family Conn.	Commercial/Industrial Conn.	Major Industrial Conn.	Municipal Conn.
2008	68,877	17,150	1,211	1,817	N/A	135
2009	69,760	17,370	1,227	1,841	N/A	136
2015	75,304	18,751	1,324	1,987	N/A	147
2029	89,367	22,252	1,571	2,358	N/A	175

Year	Projected Population	Single-Family (mgd)	Multi-Family (mgd)	Comm./Indust. (mgd)	Major Indust. (mgd)	Municipal (mgd)	Unmetered/Unaccounted for water	Avg. Day Demand (mgd)	Max. Day Demand (mgd)
2008	68,877	4.56	1.71	2.75	0.00	0.58	0.92	10.52	18.83
2009	69,760	4.62	1.73	2.79	0.00	0.58	0.93	10.65	19.07
2015	75,304	4.99	1.87	3.01	2.00	0.63	1.00	13.50	24.17
2029	89,367	5.92	2.22	3.57	5.00	0.75	1.19	18.65	33.38

**Water Conservation Forecast:** Tables 3-6, 3-8, 3-9, and 3-11 are forecasted based on continuing current water conservation efforts in the areas of pipeline leak detection, large and small meter testing and maintenance, residential fixture retrofit, reservoir maintenance, source metering maintenance, unmetered water tracking, and public education outreach.

From 1994 (when Kennewick began tracking its conservation efforts) through 2006, the City estimates having conserved 51.6 million cubic feet (Mcf) or 386 million gallons (MG) of water that might otherwise have been wasted. This averages out to approximately 29.7 MG per year. The average annual volume of water saved has reduced over time due to significant system improvements that were completed early in the City's efforts associated with water conservation. The City continues to operate an extremely efficient distribution system with very little unaccounted loss of water. Much of the past conserved water is the result of distribution system improvements rather than per connection conservation. Table 3-12 distributes volumes of water associated with the City's 2004, 2005, and 2006 water conservation effort to the applicable demand categories. The volumes of water listed in Table 3-12 can be added to the values shown in the above forecasts to determine Kennewick's demands without conservations.

Year	Projected Population	Single-Family (mgd)	Multi-Family (mgd)	Comm./Indust. (mgd)	Major Indust. (mgd)	Municipal (mgd)	Unmetered/Unaccounted for water	Avg. Day Demand (mgd)	Max. Day Demand (mgd)
2008	68,877	0.000	0.000	0.000	0.000	0.000	0.009	0.01	0.02
2009	69,760	0.000	0.000	0.000	0.000	0.000	0.009	0.01	0.02
2015	75,304	0.000	0.000	0.000	0.000	0.000	0.010	0.01	0.02
2029	89,367	0.000	0.000	0.000	0.000	0.000	0.012	0.01	0.02

### 3.4 WATER CONSERVATION PLAN

*Conservation Planning Requirements* were prepared jointly by the Washington Water Utilities Council, Washington State Department of Health (WDOH) and the Washington State Department of Ecology (WDOE). These requirements were issued in March 1994 and replaced the Interim Guidelines that were previously issued. Utilities are required to prepare a **Water Conservation Plan** in compliance with these requirements for approval of comprehensive water plans and for issuance of a water right permit.

More recently, the Washington State Legislature passed the Municipal Water Supply – Efficiency Requirements Act of 2003 otherwise known as the Municipal Water Law. This act provided water suppliers with certain benefits and obligations. This plan is intended to address water use efficiency requirements that were mandated as part of the Municipal Water Law.

This plan provides an overview of the requirements of a conservation plan and provides information on Kennewick’s current, proposed, and potential water conservation efforts.

A **Water Conservation Plan** consists of three components:

- \* Water use data collection
- \* Demand forecasting
- \* Conservation program

**Data Collection**

Kennewick has approximately 20,218 direct service connections (2006) and must meet the data collection requirements for utilities serving from 10,001 to 25,000 direct services. The data collection requirements for this size of utility are summarized in Table 3-13.

<b>Table 3-13                      City of Kennewick                      Data Collection Requirements<sup>(1)</sup></b>		
<b>Type of Data</b>	<b>Description and Frequency of Data Collection</b>	<b>Current City of Kennewick Compliance</b>
Source of Supply Readings	Read daily, report monthly, and annual totals	Yes

**Table 3-13  
City of Kennewick  
Data Collection Requirements<sup>(1)</sup>**

<b>Type of Data</b>	<b>Description and Frequency of Data Collection</b>	<b>Current City of Kennewick Compliance</b>
Emergency Interties Amount Imported and/or Exported	Collect: monthly total	Yes
Wholesale Amount Purchase and/or Sold	Collect: monthly total	N/A
Peak Day/Peak Months	Collect: Monthly totals and maximum peak day	Yes
Unmetered Water		
Unaccounted for Water	Collect: annual total	Yes
Accounted for Water	Collect: annual total	Yes
Single Family Service Meters	Collect: monthly totals <sup>(1)</sup>	Yes <sup>(1)</sup>
Multi-Family Service Meters	Collect: monthly totals <sup>(1)</sup>	Yes <sup>(1)</sup>
Commercial/Governmental/Industrial Service Meters	Collect: monthly totals <sup>(1)</sup>	Yes <sup>(1)</sup>
Agricultural Service Meters	Collect: monthly totals	N/A
Population Served	Estimate the number of customers and connections for residential, and number of connections for commercial, industrial and agricultural classes. These must be determined on an annual basis.	Yes
Economic Data	Water rates for each customer class to be documented	Yes
Water Conservation Data	Report the type of measure, the levels of implementation, the duration of the measure and the date of implementation. This information to be collected on an annual basis.	Yes
<sup>(1)</sup> Monthly data may be estimated if the water system bills less frequently		

A listed requirement for data collection is to obtain customer usage on a monthly basis. The City of Kennewick presently bills on a bimonthly basis, but the requirements of the

WDOH allow the utility to estimate the monthly consumption if the billing cycle is less frequent. The City of Kennewick complies with the requirements for data collection.

A substantial quantity of annual City water use is associated with authorized consumption that is unmetered. These uses have been tracked and reported by the City as part of the Annual Water Conservation Summary Report since 1996.

The City reports and tracks this data element for unmetered uses that include:

- \* Distribution system repairs
- \* Routine maintenance and system repairs
- \* Water and Sewer line flushing
- \* Fire-fighting
- \* Street sweeping
- \* Other miscellaneous uses authorized by City policy

The City has identified distribution system leakage as unaccounted for water. This is water that is not authorized consumption and is water lost in the distribution system. Examples of distribution system leakage include:

- \* Theft
- \* Meter inaccuracies
- \* Meter reading errors
- \* Water distribution system leakage

The City has tracked unaccounted water as an element of the Annual Water Conservation Summary Report since 1996. Table 3-14 lists the historical percentage of distribution system leakage or unaccounted water as a percentage of total water production.

<b>Year</b>	<b>Total Consumption<sup>(1)</sup> (MG)</b>	<b>Total Production (MG)</b>	<b>% Unaccounted for Water</b>
1996	2921	3406	14.2
1997	3038	3363	9.7
1998	3087	3283	6.0
1999	3229	3437	6.1
2000	3173	3406	6.8
2001	3153	3483	9.5
2002	3287	3538	7.1
2003	3373	3674	8.2
2004	3431	3739	8.2
2005	3368	3703	9.0
2006	3281	3541	7.4
Average			8.4
<sup>(1)</sup>	Total accounted for water		

Municipal water systems can experience levels of unaccounted for water from under 5 percent to greater than 50 percent of total production. Although, Kennewick has had unaccounted water as high as 14%, the City has been able to maintain an unaccounted for water below 10% since 1997.

Kennewick meets the 10% or less distribution system leakage standard and is not required to implement a water loss control action plan.

### **Demand Forecast**

The second component of the **Water Conservation Plan** is the development of a method for demand forecasting. For utilities with services ranging from 10,001 to 25,000 services (which included the City of Kennewick at approximately 20,218 services) requirements for the Demand Forecasting Model are defined in the *Conservation Planning Requirements* and as described herein.

The demand forecasts must be prepared for at least four customer classes (Single Family, Multi-Family, Commercial/Governmental/Industrial and Agricultural). The projected demand must be based on zoning, population, historical water use and

anticipated water conservation efforts. Demand forecasts, which comply with this requirement, were developed and are described in Section 3.3.

### **Conservation Program**

The third component of the **Water Conservation Plan** is the development of a conservation program. The required water conservation measures are grouped into four categories:

- \* Public Education
- \* Technical Assistance
- \* System Measures
- \* Incentives/Other Measures

The recommended measures that should be included in a **Water Conservation Plan** are included in Table 3-15. Kennewick with approximately 20,218 services and would be classified as a medium water system. The WDOH requires the City to evaluate all of the recommended conservation measures in Table 3-15 for a medium water system to determine whether to implement each recommended measure.

<b>Table 3-15 City of Kennewick Recommended Water Conservation Program for Public Water Systems</b>					
<b>Measures</b>		<b>Public Water Systems</b>			
		<b>Large<sup>(1)</sup></b>	<b>Medium<sup>(2)</sup></b>	<b>Small<sup>(3)</sup></b>	<b>Region</b>
A.	Public Education				
1.	School Outreach	X			X
2.	Speakers Bureau	X			X
3.	Program Promotion (implementation required)	X	X	X	X
4.	Theme Shows and Fairs	X			X
B.	Technical Assistance				
1.	Purveyor Assistance	X	X		X
2.	Customer Assistance	X	X		X
3.	Technical Studies	X			X
4.	Bill Showing Consumption History	X	X		
C.	System Measures				
1.	Source Meters (required if requesting water rights)	X	X	X	X
		X	X	X	X
2.	Service Meters	X	X		X
3.	Unaccounted Water/Leak Detection				
D.	Incentives/Other Measures				
1.	Single-Family/Multi-Family Kits	X	X		X
2.	Nurseries/Agriculture	X	X		X
3.	Landscape Management/Playfields - Xeriscaping	X	X	X	X
4.	Conservation pricing	X			X
5.	Utility Financed Retrofit	X			X
6.	Seasonal Demand Management	X			X
7.	Recycling/Reuse	X			X
(1)	Large Water System: More than 25,000 services				
(2)	Medium Water System: From 1,000 to 25,000 services				
(3)	Small Water System: Less than 1,000 services				

Each of these four categories and the recommended measures for a medium system are discussed in the following sections.

### ***PUBLIC EDUCATION***

Promotion of the Water Conservation program is a required. The need for water conservation should be provided to utility customers through numerous sources such as television and radio announcements, news articles and the inclusion of bill inserts.

Water conservation information is available from the WDOH for this purpose. The

AWWA has pre-printed brochures, which can be used as “bill stuffers.” The City has elected to participate jointly with the City of Richland, City of Pasco, City of West Richland, Columbia Irrigation District, Kennewick Irrigation District, Franklin County Irrigation District, and Benton PUD in the promotion of water conservation. This effort includes regional conservation mailings and other notices.

The City has also entered into a Memorandum of Understanding (MOU) with the Cities of Pasco, Richland, West Richland and the Benton-Franklin Health District for a water conservation public education and outreach program for the Quad-Cities. This MOU provide the framework for public education and outreach program provided by the Benton-Franklin Health District. This program provides water conservation curriculum for K-12 that included classroom presentations and an annual water conservation brochure.

### ***TECHNICAL ASSISTANCE***

The City provides customer assistance and bills which show consumptive history. Consumptive history for a one-year period including the current billing cycle (2 month period) is included in the City's utility bill. Customer assistance includes responding to customers questions related to water conservation. Through this assistance the customer is provided with the information on their water usage and how they can use various measures to conserve water.

### ***SYSTEM MEASURES***

System measures include requiring source and customer metering, meter testing and repair program, and system leak detection. The City continues to emphasize its water audit program and continues to pursue programs intended to reduce the

quantity of unaccounted for water. These programs have been very successful in

reducing the City's unaccounted for water as detailed in Table 3-14.

### ***INCENTIVES/OTHER MEASURES***

Recommended incentives and other measures for medium-sized water systems (1,000 to 25,000 services) include the promotion of water saving devices for single and multi-family homes, encouragement of water saving technology for nursery and agricultural applications, the promotion of low water demand landscaping, and consideration of water rates that encourage water conservation.

### **Water Conservation Measures**

There are generally two groups of water conservation measures. The first are the measures that the utility can implement. These include practices and programs such as establishing water rates, which encourage water conservation, and implementing ordinances and codes, which encourage water conservation. The second group is customer conservation measures. These include specific ways which individual customers can limit water usage. These would include modifications or replacement of plumbing fixtures and specific change in water use practices. This plan reviews both utility and customer conservation measures.

By reducing the quantity of water consumed, the need for overall system supply increases can be reduced, pumping costs to the pressure zones within the City can be reduced, and when the quantity of wastewater is reduced, a reduction in the wastewater treatment costs can also be achieved. Additional cost savings can be achieved in the reduction in energy costs for the heating of hot water for water saving measures which conserve hot water.

Conservation of water will extend the life of the existing water supply sources. Costs for water supply include capital cost for constructing the facility and operating cost for the

production of the water. The customer pays for both the initial financing of the facility and the annual operating costs. The sum of these two costs represents the total annualized cost. The cost can vary depending on the type of water source and the amount of treatment required. Groundwater production, with minimal treatment, is typically at the low end of the range at \$0.15 per hundred cubic feet (CCF). At the high end of the range is surface water treatment with costs sometimes exceeding \$0.50 per CCF. In this analysis the low-end cost of \$0.15 was used. If annualized water production costs are greater, the conservation measures selected will be more cost effective.

Water conservation can also result in a reduction in distribution system pumping cost, since a reduced quantity of water is pumped which results in reduced electrical costs. Water is currently pumped from the Water Filtration Plant and Ranney Collectors to five pressure zones. For this analysis water was assumed to be pumped to Zone 3 (average of the pressure zones). Power costs were assumed to be \$0.06 per KWH. Based on these assumptions, the cost to deliver 1 CCF of water to Pressure Zone 3 is approximately \$0.05 per CCF.

Water conservation can also provide indirect water saving costs as a result of less flow from toilets and shower drains. This results in reduced quantities of wastewater to the wastewater treatment facility. These wastewater treatment savings are similar to the water treatment plant savings and consist of capital and operating costs. They can range from as low as \$0.10/CCF for minimal levels of treatment to in excess of \$0.80/CCF for advanced treatment requirements. The City operates two aerated lagoons to provide wastewater treatment. Operating cost for this facility is on the low end of the range. An avoided cost of \$0.20/CCF was assumed in this analysis.

Since a low flow shower device reduces the quantity of hot water used, there is also a savings in energy cost to heat that water. Based on a cost of \$0.06 per KWH for electrical

energy, this relates to a savings of approximately \$0.01 per CCF.

These "avoided" costs were totaled and are summarized in Table 3-16. The total "avoided" cost of \$0.41 was used as a guide to determine if the water conservation device would be cost effective.

<b>Table 3-16 City of Kennewick Avoided Costs</b>	
<b>Description</b>	<b>Cost per CCF<sup>(1)</sup></b>
Water Supply <sup>(2)</sup>	\$0.15
Distribution System Pumping <sup>(3)</sup>	\$0.05
Wastewater Treatment	\$0.20
Energy (Water Heating)	\$0.01
TOTAL	\$0.41
<sup>(1)</sup> CCF = hundred cubic feet <sup>(2)</sup> Groundwater supply from well with chlorination <sup>(3)</sup> \$0.06 per KWH	

### ***CUSTOMER MEASURES***

Customer water conservation measures which appeared practical for the City of Kennewick were evaluated as a part of the August 1995 Water System Plan. In 1998 the City implemented a program that began distributing residential water conservation items such as toilet bags, low flow showerheads, and leak detection tables. The City continues to provide these items at no cost to City utility customers.

**Table 3-17  
City of Kennewick  
Customer Water Conservation Measures**

<b>Customer Conservation Measure</b>	<b>Water Conserved (gal/day)</b>	<b>Annual Water Conservation (CCF)</b>	<b>Capital Cost Per Measure</b>	<b>Installation Cost Per Measure</b>	<b>Total Cost Per Measure</b>	<b>Life (Years)</b>	<b>Annual Cost/CCF<sup>(1)</sup></b>
<b>Toilet Tank Displacement Bag<sup>(2)</sup></b>	4.2	2.0	\$0.10	\$0.00	\$0.10	5	\$0.01 <sup>(4)</sup>
<b>Low Flow Shower Head<sup>(2)</sup></b>	12.2	6.0	\$3.00	\$0.00	\$3.00	15	\$0.06 <sup>(4)</sup>
<b>Toilet Tank Displacement Dams<sup>(2)</sup></b>	6.0	2.9	\$1.10	\$0.00	\$1.10	5	\$0.09 <sup>(4)</sup>
<b>Ultra Low Flow Shower Head<sup>(2)</sup></b>	16.9	8.2	\$9.00	\$0.00	\$9.00	15	\$0.13 <sup>(4)</sup>
<b>Faucet Aerator<sup>(2)</sup></b>	.4	.2	\$0.50	\$0.00	\$0.50	7	\$0.50
<b>Toilet Tank Leak Detection<sup>(3)</sup></b>	10.0	4.9	\$1.65	\$11.25	\$12.90	5	\$0.66
<b>Ultra Low Flush Toilets<sup>(3)</sup></b>	24.0	11.7	\$75.00	\$67.00	\$142.00	25	\$1.14
<b>Low Flush Toilets<sup>(3)</sup></b>	12.0	5.9	\$50.00	\$67.00	\$117.00	25	\$1.87

<sup>(1)</sup> Capital recovery factor assumed annual interest rate of 8%  
<sup>(2)</sup> Assumes customer installation  
<sup>(3)</sup> Includes contractor installation cost  
<sup>(4)</sup> Cost Effective Conservation Measures (Less than preliminary avoided cost of \$0.41 CCF)

The toilet tank displacement bag and toilet tank displacement dam reduces the amount of water used to flush by holding a small amount of water out of use. Non-conserving toilets fitted with tank displacement bags use 4.8 gallons per flush versus 5.5 gallons per flush. This is a low cost measure and, since the customer installs the bag, the utility incurs no labor costs for installation. Although the toilet tank displacement dam would slightly increase the total amount of water saved, installation of the dam is more difficult than the displacement bag and has not been as readily accepted by the public.

The ultra low flow showerhead and the low flow showerhead both reduce the flow of water from the showerhead. A comparison of flows is as follows:

<u>Type of Shower Head</u>	<u>Flow Rate (gpm)</u>
Non-Conserving	5-8
Low Flow	2.5
Ultra-Low Flow	1.5

Part of the National Energy Policy Act of 1992 governs water fixtures and requires water saving plumbing fixtures for new construction. Existing fixtures do not have to be removed but new construction must include water fixtures which meet the requirements. This regulation requires a maximum flow of 2.5 gpm from a showerhead, which corresponds to the "low flow" showerhead. Although the ultra-low flow showerhead conserves more water than the low flow showerhead, customer acceptance has been less than that of the low flow showerhead and since the capital cost is significantly less, the cost for water savings is less. Since the low flow showerhead is now the standard for all new construction, customer acceptance for this showerhead should be easier to achieve. For these reasons the low flow showerhead is recommended over the ultra-low low showerhead.

## UTILITY MEASURES

The City utilizes a uniform rate structure. The current rate structure was established under paragraph 14.13 of the Kennewick Municipal Code in March of 1995. Kennewick Municipal Code 14.13.100 allows annually indexing water fees and changes of up to 100% of the Consumer Price Index (U.S. Cities – Urban Wage Earners and Clerical Workers – CPI-W) for October. The most recent rate increase was 4.0%, which was 100% of the CPI for year ending October 2005. This rate increase became effective on January 1, 2006. The City elected to forgo a rate increase in 2007.

Each connection to the Water Utility is charged bimonthly for water service on the following basis:

### Inside City Limits:

- 1) Single-family Dwelling Unit or Single Water Meter:
  - A) A service fee for a bi-monthly billing period of \$17.96.
  - B) A consumptive fee of \$1.019 per 100 cubic feet of metered water.
  
- 2) Multifamily Dwelling Unit and/or Commercial/Industrial Unit. Where all water consumption is through a single meter:
  - A) A minimum bi-monthly service fee as set forth in the following schedule:

<b>Table 3-18</b> <b>City of Kennewick</b> <b>Water Fees (Inside City Limits)</b>	
<b>Meter Size</b>	<b>Rate for 2 Months</b>
3/4"	\$34.71
1"	\$51.93
1-1/2"	\$92.36
2"	\$121.34
3"	\$184.86
4"	\$271.49
6"	\$410.16

- B) A consumptive fee of \$1.019 per 100 cubic feet of metered water.

Outside City Limits:

- 1) Single-family Dwelling Unit or Single Water Meter:
  - A) A service fee for a bi-monthly billing period of \$39.51.
  - B) A consumptive fee of \$2.242 per 100 cubic feet of metered water.
  
- 2) Multifamily Dwelling Unit and/or Commercial/Industrial Unit. Where all water consumption is through a single meter:
  - A) A minimum bi-monthly service fee as set forth in the following schedule:

<b>Table 3-19</b> <b>City of Kennewick</b> <b>Water Fees (Outside City Limits)</b>	
<b>Meter Size</b>	<b>Rate for 2 Months</b>
3/4"	\$76.36
1"	\$114.25
1-1/2"	\$203.19
2"	\$266.95
3"	\$406.69
4"	\$597.28
6"	\$902.35

B) A consumptive fee of \$2.242 per 100 cubic feet of metered water.

The current water rates were designed and were implemented to send a conservation message to City customers by including a commodity charge billed for all consumption along with a basic charge. The City reviewed several rate structures prior to the implementation of the current rate structure. This evaluation included inverted block consumptive rates and seasonal rate variations. These rate structures were rejected at that time due to the extent of the water rate increase (average 40% increase).

An inclining block rate or seasonal rate adjustment the summer months of June, July, and August would reduce peak water throughout the City. This reduction in peak flow would effectively reduce operation cost by reducing treatment and pumping cost. The City's current rate structure encourages conservation and is sufficient to provide adequate financial resources for continued operation of the system. The City is not currently considering any changes to the rate structure.

Some utilities have installed pressure-regulating valves on customer services in the

lower portions of pressure zones where the pressure exceeds 50 psi. Although this can significantly reduce water consumption, there may be some residences in the service area with galvanized plumbing that may be internally restricted. Reducing the service pressure to these customers could limit effectiveness of plumbing fixtures and could be cause for customer complaints. This utility water saving measure is not recommended because of this reason. Building code now requires pressure regulating devices be installed on service lines for new structures where the pressure exceeds 80 psi.

The City of Kennewick is fortunate in having separate irrigation systems available for customer use in meeting the water demands of lawns, gardens, and shrubbery during the summer months. The Irrigation Districts (KID and CID) are able to deliver untreated river water through open and closed conduits to agricultural and residential customers throughout the planning area. Continued promotion of the use of the separate irrigation system is considered to be a part of the **Water Conservation Plan**. New and existing developments as well as commercial, industrial, schools, parks, and other high volume users of irrigation water should be connected to these separate irrigation systems. City ordinance 17.20.050 requires new development within land classified irrigable, to connect to separate irrigation systems where available. Where separate irrigation systems are not possible, restrictions to the amount of landscaping and/or property to be irrigated from the domestic water supply system could be included in the City's Zoning Ordinance.

### **Reuse as Part of Conservation**

Included as an element of Conservation Planning is the consideration of water and/or wastewater reuse within the City of Kennewick to reduce water system demand. By utilizing reclaimed water and/or wastewater for non-domestic purposes such as irrigation, street cleaning, flushing of sanitary sewers, and industrial use, the total quantity of domestic water used may be reduced.

The WDOE has published "Water Reclamation and Reuse Interim Standards" which defines four classes of reclaimed water and how each class may be used. The four classes of reclaimed water are defined as follows:

- 1) "Class A Reclaimed Water" means reclaimed water that, at a minimum, is at all times an oxidized, coagulated, filtered, disinfected wastewater. The wastewater shall be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample.
  
- 2) "Class B Reclaimed Water" means reclaimed water that, at a minimum, is at all times an oxidized, disinfected wastewater. The wastewater shall be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample.
  
- 3) "Class C Reclaimed Water" means reclaimed water that, at a minimum, is at all times an oxidized, disinfected wastewater. The wastewater shall be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of total coliform organisms does not exceed 240 per 100 milliliters in any sample.

- 4) "Class D Reclaimed Water" means reclaimed water that, at a minimum, is at all times an oxidized, disinfected wastewater. The wastewater shall be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 240 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

The City's wastewater treatment plant consistently produces Class D Reclaimed Water. Table 3-20 shows the Treatment and Quality Requirements for Reclaimed Water for WSDOE's Interim Standards.

**Table 3-20  
City of Kennewick  
Treatment and Quality Requirements for  
Reclaimed Water Use**

Use	Type of Reclaimed Water Allowed			
	Class A	Class B	Class C	Class D
<b><i>Irrigation of Nonfood Crops</i></b>				
• Trees and Fodder, Fiber, and Seed Crops	YES	YES	YES	YES
• Sod, Ornamental Plats for Commercial Use, and Pasture to Which Milking Cows or Goats Have Access	YES	YES	YES	NO
<b><i>Irrigation of Food Crops</i></b>				
<b>Spray Irrigation</b>				
• All Food Crops	YES	NO	NO	NO
• Food Crops Which Undergo Physical or Chemical Processing Sufficient to Destroy All Pathogenic Agents	YES	YES	YES	YES
<b>Surface Irrigation</b>				
• Food Crops Where There is No Reclaimed Water Contact With Edible Portion of Crop	YES	YES	NO	NO
• Root Crops	YES	NO	NO	NO
• Orchards and Vineyards	YES	YES	YES	YES
• Food Crops Which Undergo Physical or Chemical Processing Sufficient to Destroy All Pathogenic Agents	YES	YES	YES	YES
<b><i>Landscape Irrigation</i></b>				
• Restricted Access Areas (e.g., Cemeteries and Freeway Landscapes)	YES	YES	YES	NO
• Open Access Areas (e.g., Golf Courses, Parks, Playgrounds, Schoolyards, and Residential Landscapes)	YES	NO	NO	NO
<b><i>Impoundments</i></b>				
• Landscape Impoundments	YES	YES	YES	NO
• Restricted Recreational Impoundments	YES	YES	NO	NO
• Nonrestricted Recreational Impoundments	YES	NO	NO	NO
<b><i>Fish Hatchery Basins</i></b>	YES	YES	NO	NO
<b><i>Decorative Fountains</i></b>	YES	NO	NO	NO

<b>Table 3-20 Continued City of Kennewick Treatment and Quality Requirements for Reclaimed Water Use</b>				
<b>Use</b>	<b>Type of Reclaimed Water Allowed</b>			
	<b>Class A</b>	<b>Class B</b>	<b>Class C</b>	<b>Class D</b>
<b>Flushing of Sanitary Sewers</b>	YES	YES	YES	YES
<b>Street Cleaning</b>				
• Street Sweeping, Brush Dampening	YES	YES	YES	NO
• Street Washing, Spray	YES	NO	NO	NO
<b>Washing of Corporation Yards, Lots, and Sidewalks</b>	YES	YES	NO	NO
<b>Dust Control (Dampening Unpaved Roads and Other Surfaces)</b>	YES	YES	YES	NO
<b>Dampening of Soil for Compaction (at Construction Sites, Landfills, etc.)</b>	YES	YES	YES	NO
<b>Water Jetting for Consolidation of Backfill around Pipelines</b>				
• Pipelines for Reclaimed Water, Sewage, Storm Drainage, and Gas, and Conduits for Electricity	YES	YES	YES	NO
<b>Fire Fighting and Protection</b>				
• Dumping from Aircraft	YES	YES	YES	NO
• Hydrants or Sprinkler Systems in Buildings	YES	NO	NO	NO
<b>Toilet and Urinal Flushing</b>	YES	NO	NO	NO
<b>Ship Ballast</b>	YES	YES	YES	NO
<b>Washing Aggregate and Making Concrete</b>	YES	YES	YES	NO
<b>Industrial Boiler Feed</b>	YES	YES	YES	NO
<b>Industrial Cooling</b>				
• Aerosols or Other Mist Not Created	YES	YES	YES	NO
• Aerosols or Other Mist Created (e.g., Use in Cooling Towers, Forced Air Evaporation, or Spraying)	YES	NO	NO	NO
<b>Industrial Process</b>				
• Without Exposure of Workers	YES	YES	YES	NO
• With Exposure of Workers	YES	NO	NO	NO

Based on the WDOE Treatment and Quality Requirements, the City's wastewater treatment plant effluent may be suitable for:

- 1) Trees and Fodder, Fiber, and Seed Crops.
- 2) Spray and Surface irrigation of Food Crops which undergo physical or chemical processing sufficient to destroy all pathogenic agents.
- 3) Surface irrigation of orchards and vineyards.

#### 4) Flushing of Sanitary Sewers.

An initial evaluation of potential sites available for reuse of wastewater treatment plant effluent indicates that only item 4), Flushing of Sanitary Sewers, would be feasible at this time. Large land areas for agricultural use are located at 5-miles or more from the wastewater treatment plant site, and either the land is currently not-irrigated (which would not reduce current domestic water usage) or is irrigated with untreated irrigation water currently delivered from the KID or CID irrigation systems, or from individual groundwater well sources. Although substituting wastewater treatment plant effluent for untreated irrigation water or groundwater would result in a reduction of water diverted from the Yakima River or the water aquifer, the restrictions to crop production, public access limitations, and estimated cost of transport and pumping of the wastewater effluent would preclude feasibility of this alternate. Further, reduction of untreated surface water or the reduction in use of individual groundwater wells would not result in a reduction of domestic water produced by the City of Kennewick in supplying its customers.

The City will continue to look at opportunities to reuse the wastewater treatment plant effluent for cleaning of its sewer system.

#### **Regional Conservation Program**

The Quad-Cities (Kennewick, Pasco, Richland, and West Richland) were issued Surface Water Permit No. S4-30976 on September 15, 2003 (Quad-Cities Permit). This permit required the preparation of a Regional Water Forecast and Conservation Plan (RWFCP). The Quad-Cities are in the process of preparing the RWFCP. The RWFCP will provide a common demand forecast for the four cities and details of the regional conservation program activities that are required as a condition of the permit.

The following is a summary of the conservation program elements that were include in the

Quad-Cities permit:

- \* Leak Detection Program
- \* Large Meter Testing Program
- \* Residential Meter Repair/Replacement Program
- \* Residential Retrofit Program
- \* Source Metering Replacement and Improvement
- \* Develop a Water Audit Program for Large Water Users
- \* Develop a Joint Plan with Irrigation District to Address Urban Area Irrigation Needs
- \* Develop an Integrated Water Shortage and Drought Response Plan
- \* Develop a recommended School Education Program
- \* Develop a General Public Education Program

The Cities of Kennewick, Pasco, Richland, and West Richland (Quad-Cities) are actively engaged in efforts to promote a regional approach to water supply in the Quad-Cities area and to meet the requirements of the Quad-Cities permit. The Cities will continue to coordinate their future conservation in an effort to achieve consistency in the Quad-Cities area and to help share conservation program cost when possible.

### **Summary of Water Conservation Plan**

The following water conservation measures have been implemented by the City of Kennewick:

#### Public Education:

- \* Publicize conservation news articles, service area mailings, Consumer Confidence Reports, school education programs, and utility bill inserts.
- \* Joined forces with Richland, Pasco, and West Richland on the joint distribution of water conservation guides that were distributed through the

Quad-Cities area.

- ✧ The Benton-Franklin Health District, through an MOU with the Quad-Cities, provides a public education and outreach program on water conservation for schools in grades K-12.

Technical Assistance:

- ✧ Respond to customer questions on conservation.
- ✧ Provide consumption history on customer billings.
- ✧ Water audit program for large water users.

System Measures:

- ✧ Existing meter testing and repair program.
- ✧ Routine Reservoir Leak Testing program.
- ✧ Leak detection program and systematic elimination of identified leaks.

Incentives/Other Measures:

- ✧ Provide toilet tank displacement bags, low flow showerheads, and leak detection tablets.
- ✧ Continue to promote use of the separate Irrigation District's for non-potable water use.

The City prepares an Annual Water Conservation Summary Report that provides a summary of the City's current water conservation actions and measures for the past year. This report provides additional information on the individual program elements that have been implemented as part of the City's **Water Conservation Plan** and provides data on the Water Conservation Data Collection Elements that have been utilized to ascertain the effectiveness of the City's program. A copy of the most recent report is included as an attachment to this plan.

## **Water Use Efficiency Goal**

Since 1994, total annual production has remained below the 1994 high of 3,757 million gallons. The City has been able to keep total annual production from rising above this volume due to ongoing conservation efforts described in this plan. Annual production is expected to resume a proportional increase once the effects of continued connection growth begins to outpace the volume reduction that can be obtained through conservation.

Since 1994, annual average per capita water demand has gone from a high of 186 gallons per day in 1994 to a low 136 gallons per day in 1997. The annual average per capita demand represents all customer classes and would increase with the addition of a large industrial customer or a change in climatic conditions. Although, this water use measure is problematic it is anticipated that continued conservation efforts will keep the annual average per capita demand below 170 gallons per day. The measure will be averaged over the six-year planning period in an effort to reduce the effects of climatic or industrial use changes.

The water use efficiency goal will be met by continuing with water conservation efforts have previously been implemented, conservation efforts required by the Quad-Cities permit, and by expanding the following programs:

### ***LEAK DETECTION***

Locating and repairing leaks throughout the system has returned the greatest overall benefit as a water conservation program element. A total of 288.35 million gallons of conserved water can be attributed to this program since it was initiated in 1994. As of 2006, a total of 296 miles of water main has been surveyed since 1994. The 2006 survey inspected 343,715 linear feet of water main and identified a total of 3.1 million gallons of water or 1.2% of the total unaccounted for water. Although, this is a small percentage of the total unaccounted for water continued yearly efforts of surveying

and locating leaks would ultimately reduce the unaccounted for water.

### ***WATER MAIN REPLACEMENTS***

The City's Water Main Capital Improvement Program list identifies water mains that have a history of requiring repairs due the deteriorated condition of the pipe. These mains leak a much greater volume of water that what was found as part of the 2006 survey. Replacement of these mains as part of the City's Renewals and Replacement program would be effective in reducing the unaccounted for water percent.

### ***RESIDENTIAL METER REPLACEMENT PROGRAM***

Residential water meter will continue to be replaced when found to be defective or inaccurately measuring water use. It is also expected that some area will be selected for replacement as part of a conversion to water meters that have the capability of being read through an automated system.

## **Water Supply Characteristics**

The City operates two Ranney Collector wells. These wells, which have been in operation since 1960, have a total production capacity of 14 mgd. The City also operates a surface water membrane filtration plant. This plant has a total production capacity of 15 mgd. This plant has typically only been operated from April through October to meet peak demands. The City is planning to operate the plant year round now that recent improvements have been made that will facilitate year round operation of the facility. These sources provide a present peak capacity of 29 mgd.

The Ranney wells are horizontal collector wells that produce groundwater from a shallow aquifer that is partially recharged from upgradient regional groundwater and from local

surface water in Columbia Park. Groundwater in Columbia Park is typically highest at the end of the irrigation season and lowest just prior to the beginning of irrigation season.

The surface water membrane filtration plant withdraws water from the Columbia River McNary pool. Flows in the Columbia River are controlled by a series of dams. The river has minimum instream flow that has been established under WAC 173-563-040(3). These instream flows place constraints on water rights and permits that have been issued with restrictions that are tied to the instream flows.

The City holds certificates that allow a total of 16,200 acre-feet of water to be used annually. These water right certificates provide water through the year 2019 based on the demand forecasts in chapter 3.3. The Cities of Kennewick, Pasco, Richland, and West Richland were issued a surface water permit in 2003 that provides water that is distributed to the Quad-Cities service area. This permit provided up to 178 cubic feet per second and 96,619 acre-feet per year for incremental diversion of the Columbia River in order to meet future regional water needs. The Cities are required to prepare and submit a Regional Water Forecast and Conservation Plan that details water use and mitigation associated with this permit every six years. This permit included provision that limit use of this permit during low water years and also stipulates mitigation requirements for consumptive portion.