CHAPTER 3

POPULATION PROJECTIONS

3.1 POPULATION DATA

Population projection is an important, but somewhat subjective component of the planning process. Population projections that are too low will result in a water supply inadequate to meet future needs, while projections that are too high will result in higher capital and possibly operation and maintenance costs that can be a burden to existing rate payers.

3.1.1 Previous Population Projections

A review of a number of sources has revealed differing existing populations and a wide range of population projections or estimates. A graphical representation of these different approaches can be seen in Figure 3-1.

The JM Montgomery (1979) populations from the 1979 Water Master Plan were interpreted off Figure 3-4 of the Wester report, which provided population data through the year 2020. This data was then extrapolated to the year 2037.

The Wester-Wetstein (2004) data was extracted from Figure 3-4 of the Wester report. Wester provided these population projections in the course of their work preparing the 2004 City of Gillette Water Master Plan Report.

The HKM (1994) data was also extracted from Figure 3-4 of the Wester report. HKM provided these data in the preparation of the 1993 Phase I Interim Report for Gillette Area Master Plan and the 1994 Phase II Final Report – Gillette Area Water Master Plan.

Figure 3-1

Population Projections

3.1.2 New Population Projections

The 2005 City of Gillette Housing and Demographic Survey population information was used for the underlying data for the population projections for the project. The populations given in this report differ slightly from the US Census populations for Gillette.

The US Census does not count workers that live semi-permanently in an area that claim permanent residence elsewhere, but essentially use the services on a nearly full-time basis in Gillette. Further, 2000 Census data indicates that the combined population of Antelope Valley & Crestview subdivisions is 1,642, and the populations for Sleepy Hollow is 1,177. In order to accommodate these adjustments, the 2000 City of Gillette Housing and Demographic Survey population information was used as this data included the estimated semi-permanent Gillette population. The 2000 data was chosen as a point of adjustment because it was a convenient location in time where all relevant population data were available from the US Census including subdivision populations.

In 2000, the Gillette Census population was 19,646. The City of Gillette Demographic information showed a population of 22,391. This data correlates to a semi-permanent population of 2,745. It was assumed for the purposes of this study, that these people will eventually become full-time residents of Gillette as the coal bed methane (CBM) industry matures and stabilizes and a wider selection of housing becomes available. Therefore, a new composite 2000 population of 25,210 was developed (19,646 (Census) + 2,745 (Semi-permanent) + 1,642 (Antelope Valley + Crestview) + 1,177 (Sleepy Hollow)). This approach then applies growth rates to all areas equally, including out-of-town subdivisions, and assumes that they will be served by the City of Gillette water supply system immediately for population and demand purposes. While this service transition may not occur immediately, it is highly likely it will happen over the planning period of this study.

The Bureau of Land Management (BLM) completed a study of the Gillette area that included population projections based heavily on probable future activity in the energy economies of coal mining and CBM production.[3] This study projected growth rates for two scenarios: one of low production and one of high production. Table 3-1 shows the compounded growth rates for each scenario.

TABLE 3-1
BLM Study Population Growth Rates

Lower Production	Upper Production
2000-2003: 2.53%/Year 2003-2010: 4.07%/Year	2003-2010: 4.60%/Year 2010-2020: 1.10%/Year

Based on these numbers, BLM foresees approximately 3 more years of steep growth followed by a more moderate growth thereafter. Given that the current activity with CBM can likely not continue at it present level for too long, this assumption appears appropriate for the conditions in Gillette. The idea of a boom or initial drilling and development activity followed by a moderate growth associated with maintenance of industry is reasonable. When the City of Gillette Demographic populations are studied over the 2003-2006 period, they closely match the growth predicted by the BLM report under the upper production scenario. These growth rates come in within, but on the high end of, the projected population range reported in The Gillette Comprehensive Plan.[2]

Bare mathematical models were also developed for comparative purposes. These models look at previous trends over some given period and attempt to predict future population based on the trends of the past. There are a number of these models that can be applied, with the most common being linear, power, and exponential. The data were reviewed over a number of periods of time, including 1975-2005, 1985-2005, and 1975-2005 with the 1980's boom and bust removed. The highest and lowest mathematical models from all of the permutations of model type and data era were selected and shown on Figure 3-1 for comparative purposes. These models purely project past trends and do not take into special account the growth and energy boom currently taking place in Gillette other than what is reflected in the historical data used.

Figure 3-1 shows a summary of all of the population estimates discussed above. Where appropriate, these have been adjusted to a 2000 population of 25,210 as discussed above. From this figure, it can be seen that the high production growth rates combined with the adjusted starting population resides in the middle of the range.

The adjusted 2000 population of 25,210 coupled with the compounded growth rates of the BLM report for a high production scenario will be used for population estimates for this study. Table 3-2 highlights some of the population projection points on the population curve generated by this approach.

TABLE 3-2
Predicted Population

2017	40,189
2027	44,835
2037	50,018

3.2 CONSUMPTION DATA

Daily production and consumption data from the City of Gillette Water Department were obtained for the past five (5) years for operational years 2002-2006. These data were analyzed to determine average low-flow or winter per capita usage, average daily per capita consumption, and peak day per capita usage. The monthly usages for the years 2002-2006 as well as monthly averages for this period are shown in Figure 3-2.

The City of Gillette Water Department per capita usage data appears to have been calculated using a relatively constant population of 22,000 for January and February of 2002, and then a population of 25,000 for every month thereafter. The total consumption data was adjusted for actual annual populations from the Table 7 population data from the 2005 City of Gillette Housing and Demographic Study. These more specific population data yielded slightly different per capita usage rates. The results from this analysis are included in Table 3-3.

Figure 3-2

Average Monthly Per Capita Consumption

TABLE 3-3
Consumption per Capita Data

Average Winter Consumption Per Capita	92	gpd
Average Total Consumption Per Capita (Year-Round)	190	gpd
Peak Summer Consumption Per Capita	613	gpd
Peaking Factor (Winter to Peak)	6.7	
Peaking Factor (Average to Peak)	3.2	

The peak daily flow occurred on June 29, 2005. The average winter consumption was calculated using the consumption data from the low-flow months of November through February and averaging them over the 5 year data period. Average flow data were calculated by averaging the average daily flows after they were normalized to the actual population as described above. Where necessary, peak hourly flows will be estimated by using a peaking factor of 1.5 times the peak day.[4] Generally these flows are not used for transmission sizing, but can become relevant relative to storage and distribution system considerations.

3.2.1 Fire Flow Demands

Fire flow demands of 1,500 gpm, 2,500 gpm, and 3,500 gpm are used for residential, commercial, and industrial required fire flows, respectively. The Insurance Services Office (ISO) recommends 1,500 gpm fire flow for residential (1- and 2- Family structures up to 2 stories) use.[5] Commercial and industrial fire flows are generally calculated on a case-by-case basis according to ISO recommended practices for non-sprinkled spaces. Most fire suppression sprinkler systems are designed in accordance with the National Fire Protection Agency (NFPA) and local mechanical codes. It is common to assume that commercial and industrial buildings requiring more than 2,500 gpm and 3,500 gpm, respectively, will effectively reduce their demands to below these levels by the use of fire suppression sprinklers. Durations of 3 hours are used for commercial and industrial fire demands, and 2 hours for residential fire flow demands.

Fire flow demands are assumed to be served from the system storage, and are not added into the water supply and transmission pipeline design flowrates below. Gillette has an above average storage volume that accommodates this approach.

3.3 WATER SOURCE DEMAND PROJECTIONS

The source water demand projections can be calculated by multiplying the projected population by the appropriate per capita use to arrive at a total demand. These values are tabulated in Table 3-4.

TABLE 3-4
Project Required Flows

Year	Projected Population	Winter Demand (MGD)	Average Demand (MGD)	Peak Demand (MGD)	Winter Demand (gpm)	Average Demand (gpm)	Peak Demand (gpm)
2007	32528	3.0	6.2	19.9	2,078	4,292	13,847
2017	40189	3.7	7.6	24.6	2,568	5,303	17,108
2027	44835	4.1	8.5	27.5	2,864	5,916	19,086
2037	50018	4.6	9.5	30.7	3,196	6,600	21,292
Winter Consumption = 92 gpcd							
Average Consumption = 190 gpcd							
Peak Day Consumption = 613 gpcd							

3.4 WATER SOURCE REQUIREMENTS

The existing Fort Union well field has a current maximum capacity of approximately 1,115 gpm, and the existing Madison well field has a current maximum well capacity of approximately 7,967 gpm. Two wells are currently being redrilled in the Fort Union formation which are expected to possibly raise the ultimate Fort Union ultimate capacity to 1,590 gpm. It is approximated that the existing Madison transmission line has a capacity of approximately 8,800 gpm. The peak producing well from the Fort Union formation produces 150 gpm and the peak well from the Madison formation produces 1,495 gpm. Assuming the largest well out of production for firm capacity, the preliminary peak rate to be expected from both fields combined (including new Fort

Union well estimates) is 8,277 gpm. Thus, for a 30-year design life, ultimately an alternative source must produce approximately 13,000 gpm of firm capacity source water for the peak day in addition to the existing capacity.