

CHAPTER 1 INTRODUCTION

1.1 SCOPE OF SERVICES

On January 17, 2007, the City of Gillette authorized Morrison-Maierle, with Burns and McDonnell as a subconsultant, to proceed with engineering services related to the preparation of the Long Term Water Supply Study, Level II. This study generally consists of identifying and analyzing new water sources for the City of Gillette to supplement their existing water supply.

1.2 PROJECT LOCATION

The primary project site is the City of Gillette, Wyoming. No known water source of sufficient supply is available in the immediate area surrounding the City of Gillette. The project area could extend up 75 miles away from Gillette, depending on the outcome of this study.

1.3 ACKNOWLEDGEMENTS

The project team would like to acknowledge Steve Peterson, P.E., Mike Muirhead, and Diane Monahan and their respective staff with the City of Gillette. Their assistance in providing information, data, and system records promptly has been especially helpful given the schedule of this study.

1.4 BACKGROUND INFORMATION

1.4.1 Geography

The City of Gillette, Wyoming is located on the Great Plains in the east-central Powder River Basin (PRB). The PRB is a 20,000 square mile area occupying most of the northeast quadrant of the state of Wyoming, bounded by the Black Hills to the east, the Big Horn Mountains to the west, and the Laramie Range/Hartville Uplift to the south. The PRB has five stream drainages basins forming the Upper Cheyenne River, the Belle Fourche River, the Little Missouri River, the Powder River, and the Tongue River.

The City of Gillette is located in rolling to hilly country a few miles east of a triple drainage divide, where surface water drains either west toward the Powder River, north to the Little Missouri River, or easterly into the Belle Fourche River. The closest surface water reservoirs in the area are Keyhole Reservoir to the east and Lake DeSmet to the west, with the closest source being the Keyhole Reservoir approximately 50 miles away.

1.4.2 Climate

Average annual maximum temperature for Gillette is 57.8° F, with the monthly average maximum at 86.3 ° F, occurring in July. The average annual minimum temperature is 32.6° F, with the monthly minimum being 11.2° F, in January. Total average annual precipitation for Gillette is 15.6 inches/year. Peak precipitation usually occurs in June, which has an average of 2.72 inches. Gillette receives an average annual snowfall of about 57 inches.

1.4.3 Economy

Gillette has a strong economy, with the January 2007 Unemployment Rate at 2.4%. Four of the top 10 employers in Gillette are mining companies, with a combined employment of more than 4,200 employees between them. This accounts for approximately 15% of Gillette's population. Other major employers include those in education, health care, and retail fields.

Gillette's coal mines produce over thirty percent of the nation's coal for electrical generation. These, along with vast oil reserves, natural gas production and electrical power plants have earned Gillette the title of "Energy Capital of the Nation." Increased air pollution concerns have made the coal from this area attractive, as it has very low sulfur content, making it clean burning. It is primarily shipped by rail to coal-fired power plants in the Midwest. In 1999, Campbell County produced 316.9 million tons of coal, 95% of the total coal production for the state.

The area also has a great deal of oil and gas production. Campbell County is the largest producer of oil in Wyoming. Most of the natural gas from the area is piped south to Colorado and east to Nebraska where it is used for heating.

The newest energy development in Gillette is coal bed methane. Extraction of methane gas from the coal seams that underlie the Powder River Basin began in Wyoming in the late 1980s. Methane gas is naturally occurring in coal beds. Since June 2006, the southern Powder River Basin has produced 1 billion cubic feet (bcf) of coal bed methane a day. Coal bed methane extraction also produces water. Approximately 488 million barrels of water were pumped out of southern Powder River Basin coal seams in 2006. By the year 2010, it is estimated that there will be over 100,000 methane gas wells in NE Wyoming.

1.5 DESCRIPTION OF THE PROJECT

The City of Gillette's "core" water supply comes from wells in the Fort Union Formation. Gillette currently has 13 Fort Union formation wells that range from 1,200 to 2,535 feet deep. They have pumps that range from 40-60 hp and produce between 55 and 300+ gpm. The total available capacity from this formation is approximately 1,115 gpm. All of these wells are considered "lower formation" wells based on their perforation depths below ground level. Fort Union water is very soft with hardnesses of 2 to 49 mg/l (as CaCO₃). Fluoride levels range from 1.10 to 5.47 mg/l with an average of 2.43 mg/l across all of the Fort Union wells. USEPA primary MCL limits for Fluoride are 4 mg/l, and secondary limits are 2 mg/l. Iron levels in the Fort Unions wells range from 0.04 to 0.87 mg/l, with three of the wells reporting concentrations above the 0.3 mg/l SMCL. Water from the Fort Union formation commonly includes dissolved gases including hydrogen sulfide. These gases are currently removed through the aeration process at Pump Station 1.

The City of Gillette currently gets the bulk of its water supply during peak periods from their well field in the Madison aquifer, which is used to supplement the Fort Union water. The site of this well field is approximately 14 miles northeast of the Town of Moorcroft, just off US HWY 14. This water source consists of 10 wells, each approximately 2,350-2,500 feet deep with 8 wells having 200 hp pumps and two wells having 250 hp pumps. Production from the wells varies by well with a range of 520 gpm to almost 1,300 gpm. The total capacity of the Madison well field is approximately 7,967 gpm. The water from the Madison wells is very hard – hardnesses range from 470 mg/l to 520 mg/l (as CaCO₃) from these wells. Additionally, these wells have fairly high total dissolved solids levels – 581 mg/l up to 714 mg/l, which are above the SMCL of 500 mg/l. The Madison wells do not have fluoride, hydrogen sulfide, or other gas issues.

The City of Gillette also has wells in the Fox Hills formation that are used to provide supplemental water when the Fort Union and Madison wells are operating at capacity. There are 3 Fox Hills wells drilled to depths ranging from 3,997 to 4,437 feet. These wells house two – 250 hp pumps and one 390 hp pump. The two wells with the smaller pumps produce approximately 500 gpm, while the well with the larger pump produces approximately 650 gpm. The Fox Hills wells have fluoride values reported from 6 to 9.4 mg/l. Additionally, they have sodium levels reported above 450 mg/l. The total dissolved solids levels for the Fox Hills wells range from 800 to 1280 mg/l, which is well in excess of the secondary MCL of 500 mg/l. Water from the Fox Hills formation commonly includes dissolved gases including hydrogen sulfide. These gases are currently removed through the aeration process at Pump Station 1. Due to their poor water quality, the Fox Hills wells are only used in crisis situations as a source of last resort, and even then they are still throttled to a maximum of approximately 1/3 of their capacity due to blending issues.