EXECUTIVE SUMMARY

The City of Gillette is experiencing aggressive population growth due to burgeoning energy development in Campbell County in particular and Wyoming in general. With this population growth comes increased water demands which, during peak periods of usage, are taxing Gillette's existing water supplies.

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.

Water Demand Projections

Land use planning, population projections, and water usages were analyzed, and estimates for each were made for the 30 year planning period. The planning district boundary (PDB) includes approximately 56 square miles of land. The population projections were based on methodology and growth rates presented in the BLM report titled: *Task #C Report for the Powder River Basin Coal Review Cumulative Social and Economic Effects.* The total planning population for the year 2037 is 50,018. The average per capita water use is 190 gallons per capita day (gpcd), which matches the annual average per capita consumption in the last five years. A peaking factor for the peak day of 3.2 was determined from historic records and was used for predicting future water demands. The 2037 peak day is estimated to be 21,292 gallons per minute (gpm).

Gillette's existing water supply has a peak firm capacity of 8,277 gpm with the largest producing well out of service (M-9). This needed capacity leads to a 2037 water deficit of 13,000 gpm firm capacity, which is used as the planning target for the purposes of this study.

A number of surface and groundwater sources were evaluated for Gillette's long term water supply. Of these, the only source that could reliably and economically provide the needed water for the 30-year planning period was the Madison aquifer. The Madison source is a significant distance from Gillette, and any alternative utilizing it as a source will take significant funding and time to construct. Since Gillette is experiencing an immediate water shortage right now, short-

term “bridging” measures were also evaluated to help Gillette through the planning, design, and construction periods necessary to construct a new Madison supply.

Regionalization

The concept of regionalization was analyzed under this study. Crestview and Antelope Valley subdivisions and Campbell County Improvement District (Sleepy Hollow subdivision) were identified as the strongest candidates for regionalization with the primary Gillette system. Such a concept is only attractive to Gillette if these communities were annexed into the City of Gillette. It is recommended that their inclusion into the Gillette system be made in two phases: Phase 1– to tie all the systems together and make improvements to provide a functioning “island” system that has some adequate redundancy, and Phase 2 – the eventual connection of this “island” system into Gillette primary water system once the long-term supply is built and in-place. The estimated costs for Phase 1 are $10.7 million. Phase 2 costs were not estimated due a number of unknowns about time of execution and potential cost sharing scenarios.

Interim Water Supply

Three initial short-term alternatives were developed to provide firm capacity to the City of Gillette for an 8 year planning period. None of these alternatives met the criteria of being a stand alone, economical, constructible in a reasonable period of time, and posing an acceptable level of risk. Subsequently, four emergency short-term alternatives were then developed to be used in conjunction with each other until a long-term supply is done: increased conservation efforts, reuse of coal bed methane (CBM) water, redrilling in-town pre-1980 Fort Union wells, and treating the water from Gillette’s existing Fox Hills wells.

Continued and increased conservation efforts will provide some demand relief. For the purposes of this report, a 15% reduction in demand was assumed. This alternative is the lowest short-term cost incremental change that can be made as well as the fastest and easiest to implement. However, it is not predicted to reduce demand to the point that the existing system will make it all the way through the 8-year period.

The Fort Union well redrilling is a viable short-term supplement, but will take some time to implement. The Fox Hills treatment is also a viable option, but is both capital and operation and

maintence (O & M) cost intensive. CBM water still presents many unknowns at this point, any of which could be a fatal flaw.

It is our recommendation that increased conservation be pursued first, with the CBM water and Fort Union well redrilling pursed second on ***concurrent, parallel paths*** to ensure CBM water is thoroughly evaluated without losing time pursuing another option. This concurrent approach should be pursued until a point of diminishing returns is reached, presumably at the point in time when capital funds are expended. The Fox Hills treatment would be the third choice for implementation due to its cost. This option may need to be implemented until the Fort Union wells can be drilled, or for peaking toward the end of the 8-year period.

Long-Term Water Supply

Several long-term source alternatives were considered including Lake DeSmet, Keyhole Reservoir, Clear Creek, wastewater treatment plant effluent reuse, the Wasatch aquifer, the Fort Union aquifer, the Fox Hills aquifer, the Madison aquifer, and CBM water. After an initial screening process, it was determined that the only feasible and reliable source was the Madison aquifer. Consequently, alternatives were developed based on the Madison source which included multiple variations of pipeline size and material, pump station location, reservoir location, storage mechanism, and pipeline tie-in point to the distribution system. Another screening process determined the following alternatives were determined to be technically viable: a surface water impoundment that receives water from the existing Madison infrastructure during times of low demand, a new Madison wellfield, pump a station, and a pipeline that will essentially parallel the existing Madison system. Both alternatives assume continued use of the existing Madison infrastructure. This existing infrastructure is currently being evaluated and its exact condition is unknown.

The surface water treatment option includes a reservoir to store water, a water treatment plant to meet the requirements of the Surface Water Treatment Rule (and subsequent surface water rules), a pump station, and a new pipeline into town. This option is cheaper in initial capital cost, but more expensive to operate and maintain. The total initial capital cost for this option is estimated to be $101,103,000. A subsequent capital expenditure to expand the plant in year 2023 is estimated to be $29,973,256 at that time.

The new Madison parallel source involves drilling a new Madison wellfield northeast of the existing Madison wellfield. The preliminary wellfield sizing is based on ten 16-inch diameter wells, hydraulically fractured as needed, producing 1,430 gpm each. These estimates are professional estimates and not a guarantee that any one well or the group of wells will meet this performance. A 36-inch pipeline from Pine Ridge reservoir to a new pump station in the vicinity of the existing Donkey Creek pump station would be 36-inch PVC pipe. From the new pumping station into town, the line would be 42-inch steel and PVC, depending on the pressure in the pipe at given locations. This alternative has a higher estimated capital cost of $158,246,000, but will require less O & M expenditures and will not require a large future expansion to meet the 2037 water supply goal.

A number of other factors beyond capital costs should be considered when selecting a preferred alternative. Factors such as operation and maintenance (O & M) cost, present worth, ultimate rate impact, time to implementation, water aesthetics, emergency redundancy, and useable life are all important decision criteria.

O & M costs were estimated for both alternatives. In order to provide an accurate comparison, the O & M costs were estimated for each year of the 30-year planning period. These costs were then brought back to a present worth value and amortized over the planning period. Simply stated, this provides a yearly “apples-to-apples” comparison. The O & M costs for the surface water impoundment alternative are $753,500 per year, while the O & M costs for the Madison pipeline and wellfield alternative are $200,200 per year.

A present worth analysis was performed on both long-term alternatives. The results are shown in Table 1 below. It is important to note that this calculation is highly sensitive to minute shifts in the discount and construction inflation rates as can be seen below. A 1% change in the discount rate creates a shift in present worth of $12.6 million, or approximately $1.6 million per 1/8 percent change. A similar sensitivity can be seen to construction inflation rates. A 1% change in construction inflation causes an $11.7 million shift in present worth, or about $1.5 million per 1/8 percent change. The initial present worth calculation was based on a 4.875% discount rate and 5% annual construction inflation. At these rates, the surface water impoundment has a slightly more favorable present worth rate. However, once the sensitivity analysis was completed, it can be seen that even small departures from these rates can cause a change in which alternative has the most favorable present worth. With the present worth

results coming out so close, it was determined that in this respect the alternatives were substantially similar.

Table 1

Present Worth Sensitivity Analysis

Interest Rate	Surface Reservoir	New Well and Pipeline Alternative
4%	-$76,732,979	-$70,189,507
4.5%	-$80,395,864	-$80,624,952
4.875%	-$82,605,954	-$87,310,640
5%	-$83,251,466	-$89,343,678

*Construction Inflation Held at 5%/Year

Construction Inflation	Surface Reservoir	New Well and Pipeline Alternative
4%	-$88,068,411	-$101,670,196
5%	-$82,605,954	-$87,310,640
5.5%	-$78,794,906	-$78,031,968
6%	-$74,113,261	-$67,081,188

Discount Rate Held at 4.875%/Year

Less favorable present worth
More favorable present worth
Both alternatives comparable

Assessing the impact to rate payers required developing funding strategies to set financing rules. Two funding scenarios were developed: Scenario 1) 67% Wyoming Water Development Commission (WWDC) grant funding for eligible components, 33% Drinking Water State Revolving Fund (DWSRF) loan funding at 2.5% interest, with 100% WWDC ineligible components funded by DWSRF, and Scenario 2) 67% grant from Budget Reserve Account, 33% loan at 4% interest from Budget Reserve Account. As shown in Tables 2, 3, and 4 below, the Madison pipeline alternative has a drastically lower rate under Scenario #1, and a slightly lower rate under Scenario #2.

Table 2

Base Rate Increases-Funding Scenario #1

Alternative	Increase in Base Rate ($/1,000 gal)	Total New Base Rate($/1,000 gal)
New Madison Wells and Pipeline	1.86	4.16
Surface Water Impoundment and Treatment	2.70	5.00

Table 3

Base Rate Increases-Funding Scenario #2

Alternative	Increase in Base Rate ($/1,000 gal)	Total New Base Rate($/1,000 gal)
New Madison Wells and Pipeline	2.21	4.51
Surface Water Impoundment and Treatment	2.28	4.58

Table 4

Total Average Residential Monthly Rate (existing = $32.89)

Alternative	Scenario #1 Rate	Scenario #2 Rate
New Madison Wells and Pipeline	59.49	64.49
Surface Water Impoundment and Treatment	71.50	65.49

An analysis of emergency redundancy, water aesthetics, and useable life are all included in the non-economic analysis. The table below highlights the evaluation of these factors.

Table 5

Non-Economic Evaluation

Criteria	Surface Reservoir	Pipeline	Importance	Surface Reservoir Ranking	Pipeline Ranking
Redundancy	+	++	10	10	20
Water Quality	+	+++	8	8	24
Difficulty of Operations/Logistics	+	+++	7	7	21
Compatibility with CBM Water Sources	+++	+	6	18	6
Future Regulatory Challenges	+	+++	6	6	18
Timeline to Implementation	+	++	8	8	16
Regionalization Potential	++	+++	3	6	9
Softening Synergy	+++	++	3	9	6
Longevity of Facilities	++	+++	9	18	27
			Total	90	147

The time to implementation for the pipeline project is estimated to be 5 years, while the timeline to implementation for the surface impoundment is 6 years. Given Gillette's critical water need, this additional time to implementation favors the Madison wellfield and pipeline alternative. These estimates are best-case with fast-track design. Any delays in these processes will delay the completion of the project

Table 6

Comparative Summary

	Madison Wellfield and Pipeline	Surface Impoundment with Treatment
Capital Cost		X
O & M Cost	X	
Present Worth	-- (Tie – Each within margin of error)	-- (Tie – Each within margin of error)
EDU Cost – Scenario #1	X	
EDU Cost – Scenario #2	X	
Non-Economic Analysis	X	
Time to Implementation	X	

X – Preferred Alternative

Final Recommendation

Based on the evaluation of all factors, the new Madison pipeline, pump station, and wellfield is the preferred alternative. The increased capital cost of this alternative is offset by lower O & M costs; non-economic benefits such as: a longer anticipated life, better water aesthetics, better emergency redundancy; a shorter timeline to implementation; and potentially a lower impact to rate payers, depending on the final funding package.